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TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY BULLETIN.

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DISEASES DUE TO PROTOZOAN PARASITES.

BRUMPT (E.). **Les piroplasmes des bovidés et leurs hôtes vecteurs.** [The Piroplasms of Cattle and their Transmitting Agents.]—*Bull. Soc. Path. Exot.* 1920. June 9. Vol. 13. No. 6. pp. 416–460. With 12 figs.

This comprehensive memoir should be consulted in the original by all those who desire to obtain succinct information upon the facts hitherto ascertained with regard to piroplasms in cattle. It is not possible to do more than review the most recent knowledge and essential points in the course of an extract.

Brumpt has been engaged upon a study of the bovine piroplasms since 1913, and, as he states, their identification is not always easy, largely on account of the polymorphism of certain species and also on account of the difficulty of utilising the usual laboratory methods for this purpose. As they are adapted exclusively to living in the blood of cattle and perhaps certain deer or wild cattle, it is impossible to make use of small laboratory animals for their differentiation as one does with trypanosomes.

In order to study them properly one must have at hand clean cattle, obtained from countries free from piroplasms, or animals born and bred indoors. Again, when one works with calves the subject becomes somewhat complicated, as these animals sometimes present infections that remain latent or not apparent and can only be revealed by injecting their blood into older, susceptible, animals. Nevertheless, in spite of these difficulties, it would be a matter of considerable economic interest to identify in a thorough scientific manner the various species of piroplasms.

There are two methods by means of which one may attempt to differentiate the piroplasms of cattle, viz.: (1) by their morphological and (2) by their biological characteristics.

Morphologically, one can by a study of pure and intense forms of infection admit seven species of piroplasms and two species of anaplasms.

Biologically, one may take into account at least seven characteristics :

(1) All species when tested by inoculation are transmissible to clean animals with the exception of *Theileria parva,* the cause of

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East Coast fever. In all cases, except in *T. parva* infection, the infected and recovered animal harbours the parasites in its blood, which may remain virulent for more than 12 years with *P. bigeminum* and for 6 years, at least, with *Anaplasma argentinum*.

(2) The pathogenicity is a very important characteristic and enables one to differentiate various species according to the degree of fever, redwater, anaemia, jaundice, etc., provoked.

(3) The nature of the transmitting agents enables one likewise to determine some species, but this procedure cannot always be adopted, for certain parasites, such as the anaplasms, appear to be spread by ticks of very different species and genera.

(4) Their mode of development in the ticks is almost unknown and the descriptions given by certain authors have not been confirmed by others. This study is incapable, at the present time, of rendering assistance.

(5) The stage in which the tick is capable of becoming infected on the virus-carrying animal and the stage in which it transmits the disease furnish interesting differentiating characters, which enable one to proceed with the application of appropriate preventive measures. The mode of development of each piroplasm remains constant, no matter what transmitting agent is utilised. The author's work on the development of the dog piroplasm makes this point quite clear. [See this *Bulletin*, Vol. 8. No. 1, p. 3, and No. 2, p. 98]. *P. bigeminum*, which passes through the eggs of Margaropus ticks, maintains this same peculiarity when it develops in *Rhipicephalus appendiculatus*. Information with regard to the mode of development and transmission of each piroplasm, as well as the special biology of each tick is, therefore, a necessity in order to obtain some guidance on what is the species or several species of ticks indigenous to any given country that are capable of bringing about the transmission of the parasite.

(6) The best means of diagnosis is the so-called "cross artificial immunity test." In the hands of LAVERAN and MESNIL this test has been of great service in these authors' systematic study of the trypanosomes. The method has also enabled THEILER, MCFADYEAN and STOCKMAN, LIGNIÈRES, and Brumpt to single out some species of piroplasms.

(7) There is, however, a "cross natural immunity test," which is much superior to the above-mentioned artificial immunity test. This test consists in causing animals recovered from a piroplasmosis to be bitten by ticks harbouring a known pure infection. If the bitten animal reacts in the same manner as the control animals the second species with which it was infected would be different from that with which it was originally infected.

This method, in the author's hands, was found capable of furnishing excellent results in the identification of the fowl spirochaetes, and the results, moreover, were quite in harmony with those obtained with the cross artificial immunity test. Thus, fowls hyperimmunised against *Sp. neveuxi* of Senegal become infected on the 6th day, in the same manner as the controls, when bitten by Argas ticks harbouring *Sp. gallinarum*. Therefore, in the course of nature, fowls hyperimmunised against the Senegal spirochaete and despatched to countries where *Sp. gallinarum* exists would become infected and probably die just as readily as clean birds.

Experiments of this kind are difficult to accomplish with cattle, especially on account of material difficulties. However, by using *Margaropus australis* ticks obtained from Brazil, the author was able to set up quite easily in France mixed infections due to *P. bigeminum* and *P. argentinum*, or pure infections due to *P. argentinum*. It was then found that larvæ obtained from the ticks that had produced these infections were quite incapable of reinfecting the recovered animals in spite of the fact that thousands of adult ticks were subsequently recovered on them. A natural super-infection would not thus seem to have taken place. In any country, if the animals have already become infected with one species of tick and then react to the bites of ticks of the same species obtained from other countries and then show piroplasms in their blood, the piroplasms in question would obviously represent different species.

This phenomenon of cross natural immunity can be readily observed if one makes an epizootiological study of the piroplasmoses. Thus cattle imported from Texas and Australia into South Africa do not contract redwater (THEILER); cattle from Southern Italy are resistant towards the same disease when they are imported into Eritrea (CARPANO). On the other hand, animals immunised in Texas against the piroplasms and anaplasms of the country, and animals vaccinated by LIGNIÈRES in Argentina against *P. argentinum* and *P. bigeminum*, die of tristeza in Brazil. It would appear, therefore, that there are piroplasms of the *bigeminum* type in Brazil which are different from those of Argentina and Texas. This view has already been put forward by two Brazilian authors, MIRANDA and PARREIRAS HORTA (1913), who denoted the Brazilian piroplasm *P. australe*.

Preliminary experiments of this kind were undertaken with the dog piroplasms in cattle diseases in order to elucidate this problem of high scientific and economic importance.

The author then passes under review the different species of cattle piroplasms which he considers valid in our present state of knowledge.

Piroplasma bovis (Babès 1888 pro parte).

Syn. *P. divergens*, MCFADYEAN and STOCKMAN, 1911; non *Microbabesia divergens*, SOHNS, 1918.

The parasites originally insufficiently described by BABÈS in 1888 in the red blood corpuscles of cattle dying of redwater in the marshy Danubian plains belonged, it would seem, to two different types, viz., (1) a small piroplasm which has since been seen in various parts of Europe, and (2) a large piroplasm which can be no other than *P. bigeminum*, SMITH and KILBORNE, of world-wide distribution. These two species in fact have been found in Bulgaria by MARKOFF (1916), and as far back as 1900 LIGNIÈRES received from a certain locality in Roumania, where redwater was in existence, two species of ticks: (1) *Ixodes ricinus*, the transmitting agent of *P. bovis*; (2) *Margaropus calcaratus*, which transmits *P. bigeminum*, as Brumpt himself has demonstrated experimentally with samples of this species collected in Tunisia by NICOLLE (Ch.). It is, therefore, certain that BABÈS saw two different species of piroplasms. Inasmuch as he would appear to have described in the first place the smaller one, Brumpt maintains that by the application of the law of priority the specific name *bovis* should be maintained to denote this small European species, and that the specific name *bigeminum* should be relegated to the large species found in the south of Europe and in tropical countries, the name *bigeminum* being that originally applied to it by SMITH and KILBORNE.

P. bovis has thus been found in the ox in Roumania, France, England, Finland, Germany, Holland, Denmark, Italy, Switzerland, Bulgaria, Russia, Norway, Sweden, Belgium, and Portugal. According to BETTENCOURT, FRANÇA and BORGES it is also found in the stag (*Cervus elaphus*).

Quite recently VRIJBURG [*see* this *Bulletin* 1919. Vol. 7, p. 14] wished to identify the species with *P argentinum*, LIGNIÈRES and *P. annulatum*, DSCHUNKOWSKY, basing his contention upon the morphological aspect of certain forms of these parasites. This view, according to Brumpt, is quite indefensible for it would appear to be controverted by clinical observations and experimental tests. By means of the cross immunity test Brumpt showed that an animal recovered from a *P. bovis* infection (Normandy strain) was susceptible to *P. argentinum*. Moreover, by the agency of ticks, he was able to transmit neither *P. argentinum* by means of *Ixodes ricinus* nor *P. bovis* by means of hundreds of samples of *Margaropus australis*.

P. annulatum is discussed later.

A Dutch author SOHNS (J. C. F.) in 1918 described under the name *Microbabesia divergens* in the Dutch East Indies parasites which he identified with the European piroplasm and also with *P. argentinum* [*see* this *Bulletin*, 1919, Vol. 7, No. 1, p. 15].

Judging from the description and figures given by this author, Brumpt considers rightly that none of these forms can be attributed with certainty to *P. bovis*, and none of them is placed at the periphery of the corpuscle as is frequently seen in pure infection due to this parasite. Moreover, the piroplasms described by this author were transmitted by Margaropus and, as Brumpt has shown, this kind of tick cannot propagate *P. bovis* (= *divergens*). It is probable, Brumpt maintains, that SOHNS was dealing with a mixture of *P. bigeminum*, *Theileria mutans*, and probably *P. argentinum*, or, at least, a species which resembled it morphologically.

P. bovis is transmitted by *Ixodes ricinus* (KOSSEL, WEBER, SCHUTZ, and MIESSNER, 1903), and transmission is hereditary: larvæ obtained from ticks collected on affected animals proved infective. Likewise these authors showed that the nymphs obtained from infected larvae were infective. In this respect the piroplasm would appear to be very different from *P. canis*, but it is just possible that in the experiment in question the infection might have been transmitted hereditarily and preserved up to the nymph stage. In England, STOCKMAN and NUTTALL have proved the part played by larvæ in infection.

In France Brumpt had numerous failures in attempting to infect young animals with the larvae, but it was not possible to ascertain whether these animals had contracted a latent infection. He succeeded in transmitting the infection to a calf by allowing it to be bitten by nymphs that had retained the infection hereditarily or that had contracted it on young animals harbouring a latent *P. bovis* infection. From his epizootiological studies it would seem that adult *Ixodes ricinus* prove infective only in a small percentage of cases. It was not found possible to infect a calf by causing it to be bitten by hundreds of adult ticks of this species which, as nymphs, had infected the calf mentioned above. But, here again, a test of the virulence of the blood could not be undertaken. STOCKMAN succeeded in transmitting this parasite, or perhaps the large English piroplasm (for this author does not give precise details on this point), by means of another cattle tick *Hæmaphysalis punctata* CAN and FANZ; on analysing the results of his experiments Brumpt concludes that this tick is only by accident a transmitting agent and is less adapted for the purpose than is *Ixodes ricinus.* The nymph only appears capable of playing a part in the development of the parasite. In France the disease is transmitted by *I. ricinus*, which is abundant everywhere , *H. punctata* is rarely found and Brumpt found only one sample of this tick on cattle in the west of France in 1917 and 1918. On the other hand he often found *Dermacentor reticulatus*, from October up to the end of April, but this species cannot act as intermediate host inasmuch as it disappears when the first cases of piroplasmosis are observed and re-appears when cattle piroplasmosis disappears.

In France this piroplasm produces a rather low mortality—4–8 per cent. of those that become affected with redwater succumb. The period of incubation varies from 5 to 28 days. Fever is observed for 1 to 7 days (up to 41° C.), redwater appears as a rule 2 or 3 days after the commencement of the fever and lasts 1 to 4 days. The symptoms are especially marked in aged cattle In Norway it appears that 100 per cent. of affected cattle may die of the disease, and in Germany sometimes up to 50 to 60 per cent. According to MOUSSU and other authors treatment by means of trypan blue is efficacious.

Piroplasma argentinum, LIGNIÈRES, 1901.

This parasite was specially described by LIGNIÈRES in 1901 in Argentina, and designated by the above name in 1903. It is always very rare in the red corpuscles in the peripheral blood. (In 1898, however, A. BETTENCOURT encountered in Portugal in 13 cases of redwater a small parasite from 1 to 2 microns in diam., which was always very rare in the peripheral blood and resembled fairly closely *P. argentinum* ; *P. bovis* and *P. bigeminum*, it is remarked, are generally quite abundant in the blood). Even in the acute forms of the disease it is sometimes difficult to find these parasites, but they occur in abundance in the heart muscle and in the kidneys. The corpuscles which contain the parasites are often very small in size; the rounded forms of the piroplasms are generally seen singly within the corpuscles in the peripheral blood, rarely in twos, threes, or fours. Their average diameter is 1 to 1½ microns. Pear-shaped forms are fairly often seen which are two or three times smaller than those of *P. bigeminum*, and when they occur in pairs they are inclined towards each other at a divergent angle in much the same way as *P. bovis.* A characteristic which enables one to distinguish these parasites from those of the latter species is that they are never placed towards the surface of the red corpuscle.

Brumpt believes from the descriptions given by ZIEMANN (1902) that this parasite is found associated with *P. bigeminum* in Venezuela. It also occurs in Brazil and probably in the Panama region, where it was found by CLARK in cattle and deer. Forms resembling it morphologically were found by Brumpt in a Brazilian deer.

LIGNIÈRES transmitted the infection with *Margaropus australis*, and Brumpt succeeded also in transmitting it in France with ticks of the same species obtained from Brazil. The disease produced by the parasite appears to be more severe than that produced by *P. bigeminum* alone. According to LIGNIÈRES, one can vaccinate against *P. bigeminum* by means of *P. argentinum* and vice versa. In mixed infections the disease does not appear to be more severe than in infections produced by *P. argentinum* alone. The parasite has not been encountered in Europe, and it would appear that the species was originally harboured by the South American deer. Treatment with trypan blue appears to be efficacious in some cases.

P. bigeminum, SMITH and KILBORNE, 1893.

Described in the classical researches of SMITH and KILBORNE in the United States in 1903. This is the best known piroplasm of cattle. The rounded form is common and elongated or ovoid forms are not rare, but the pear-shaped forms are the most characteristic. Even the smallest pear-shaped forms are swollen in appearance, so that they can be easily distinguished from *P. bovis* and *P. argentinum*. In acute cases of the disease 5 to 75 per cent. of the red corpuscles in the peripheral blood are invaded, while in the viscera, and especially in the heart muscle and kidney, from 20 to 80 per cent. contain the parasites.

This piroplasm exists in Europe in districts where Margaropus ticks are found—that is, in low-lying districts below 44° Lat. It has been found in Roumania, Greece, Bulgaria, Italy and in Portugal, and probably also in the South of Spain. This is interesting, inasmuch as it was from that country that animals were first exported into America, and the causal agents of Texas fever would, therefore, have originated from that country. The Margaropus tick of Southern Europe (*M. calcaratus*) does not appear to have been carried over in this way, but in America there are other species of this genus, *M. annulatus* and *M. australis*, which would appear to have acquired the capacity of acting as vectors. Inasmuch as these last-named ticks cannot live in North America above 37° Lat. and in South America below 35° Lat, one can understand why the infested zone in America is less extensive than in Europe, where it reaches 44° Lat., owing to the difference in the biology of *M. calcaratus*. The parasite is also found in many other parts of the world, usually associated with *Theileria mutans*, *Anaplasma marginale*, or other piroplasms. It has been found in Eritrea at an altitude of 2,400 metres. The species found in Texas, India and Madagascar are no doubt identical with that found in South Africa, for animals imported from those countries into South Africa behave like immune animals. Sardinian cattle imported into Eritrea contract only a slight disease, due to *T. mutans*. Zebus from India and Madagascar survive quite well in tropical America, so that they are likewise insusceptible to infection with *P. argentinum*.

On the other hand, cattle imported from Texas into Brazil succumb to piroplasmosis, so that the species found in Brazil is probably different.

There also exists in Northern Europe a piroplasm identical morphologically with *P. bigeminum*. Its presence has been recorded in England, Finland, Holland and Germany, but it has not yet been seen in France. In some cases this parasite appears to have a high degree of pathogenicity.

M. annulatus passes the whole of its development on one host, so that infection takes place only by hereditary transmission. In South Africa the common vector is *M. decoloratus*. In Asia Minor *M. calcaratus* transmits the disease. When larvae obtained from infected females develop on immune animals, such as the sheep, horse, etc., they become non-infective. However, THEILER recorded a case in which larvae obtained from ticks collected on a horse were infective. Very few species other than those belonging to the genus Margaropus are capable of acting as vectors. In the United States *Dermacentor variabilis* and *Amblyomma americanum* have been proved to play no part in transmission. *Ixodes ricinus* and a nearly related species, *Ix. scapularis,* do not appear to play any part. Clean *M. annulatus* placed on an animal infected six years previously became infected. Nevertheless, THEILER transmitted the infection by means of a dropping off tick, *Rhipicephalus appendiculatus.* It seems possible that the somewhat rare presence of the parasite in Northern Europe is the cause sometimes of rupture of the spleen. According to KNUTH, *Haemaphysalis punctata* would appear to be able to transmit the disease, in the same manner as, according to STOCKMAN, it transmits *P. bovis.* It is well known that the parasites persist for a long time, up to 12 years, in the blood of a recovered animal.

Piroplasms and Rupture of the Spleen.

Cases of sudden death, due to spleen rupture, have been observed in cattle in Germany, Holland and Denmark for some time, and the disease is only seen while the animals are out at grass, in the spring or early summer, and it generally occurs in open flat spaces that are not wooded, where *H. punctata* is found abundantly. *I. ricinus,* on the other hand, is found most commonly in marshy and wooded districts. The condition is seen in adults, very rarely in young animals, and after a short period of incubation. Cases usually occur singly in a herd, and may be easily mistaken for anthrax. KNUTH recorded the affection along the Baltic and North Sea coasts, and alleged that it did not occur in countries where tropical bovine piroplasmosis existed. However, it seems to have been described by NICOLLE (M.) and ADIL BEY (1899) in Constantinople, and by CLAUDE and SOULIÉ in 1901 in Algeria, and there still remains some dispute whether spleen rupture is due to a particular species of piroplasm which is different from *P. bovis* or *P. bigeminum,* while some authors consider that the condition has nothing to do with piroplasmosis. Relapses are well known to occur in cattle during an attack of some depressing affection such as rinderpest and East Coast fever, or in overworked, ill-nourished, low-conditioned animals. It would also appear that no worker has yet succeeded in reproducing this splenic condition, resulting in sudden death, by inoculation experiments, but the tests are not numerous enough to draw therefrom settled conclusions, although there seems to be no doubt that it is associated at least in Northern Europe with piroplasmosis. In Holland, Germany and Denmark observers claim that there is a difference in the geographical distribution of the two conditions—redwater and spleen rupture followed by sudden death—and DE JONG and KNUTH'S views that the latter condition is caused by a particular type of piroplasm are therefore feasible.

Theileria parva (THEILER 1904).

Syn. *Piroplasma annulatum* DSCHUNKOWSKY and LUHS, 1904 *pro parte*; *P. kochi* LIGNIÈRES, 1905. Not to be confounded with *T. mutans.* In *T. parva* infection from 80 to 96 per cent. of the blood corpuscles are infested while in *T. mutans* infection rarely more than 50 per cent. are invaded.

This parasite was first recorded on the East Coast of Africa. It was imported into Rhodesia in 1901, and to the Transvaal in 1902. It is found also in Uganda, Eritrea, Egypt, Cyrenaica, Tunisia, where it has been described in summer (DUCLOUX 1905), Transcaucasus region; Macedonia, and India (MONTGOMERY). According to KOCH zebus imported from the northern part of Madagascar into East Africa resisted the disease, while those from the south succumbed. The disease has not yet been found in the Belgian Congo and in West Africa, where, however, certain species of ticks that might be capable of transmitting it have been recorded. The same or nearly related species have been found in Uganda by Ross (P.H.) in 1909 in a hartebeest, and by LICHTENFELD in 1911 in German East Africa in an eland antelope. These antelopes were probably the original vertebrate hosts of *T. parva*, but at present the reservoir is the domestic cattle.

The common vector is *Rhipicephalus appendiculatus*(=*R. nitens*) which changes its host three times, becomes infected in the larval or nymph stage, and transmits the infection in the succeeding stage; infection is not hereditary; the tick becomes infected in from 95 to 100 per cent. of cases. The continuous feeder *Margaropus decoloratus* does not transmit the infection. *Rhipicephalus evertsi*, which changes its host twice, and *R. capensis* and *R. simus*, which leave their host for each moult, are capable of transmitting the infection (THEILER). According to NUTTALL and HINDLE, *R. appendiculatus* does not become infective for two or three days after becoming attached to a susceptible animal.

CARPANO considers that *Hyalomma aegyptium* is the vector of *T. parva* and *T. mutans* found in Mediterranean Coast fever. This tick lives normally in the larval and nymphal stage on small animals, such as rabbits, hares, birds and hedgehogs, from which it cannot obtain the piroplasms. In natural conditions it is found on cattle in the adult stage. Brumpt found experimentally that the larvae of some broods were capable of developing on cattle and that the nymphs that had lived as larvae on the rabbit were capable of becoming engorged on these animals—thus lending support to CARPANO'S view. It is probable that in Macedonia, the Transcaucasus region, and Tunisia the vector is perhaps *R. simus*, which exists in Egypt and Mitilene or, more likely, *R. bursa*, which is very common on cattle in all its stages, or yet *R. sanguineus*, which may be accidentally found on cattle. The mortality from this condition among adult animals is from 95 to 100 per cent. Recovered animals acquire a permanent immunity and the parasites disappear completely from their blood and glands.

Theileria mutans (THEILER 1906).

Syn. Th. sp. DODD, 1910; *Piroplasma annulatum*, CARPANO, 1915; *non* DSCHUNKOWSKY, 1904; *T. parva*, CARDAMATIS, VELU, etc.

This parasite, which presents an identical appearance to *T. parva* in the peripheral blood, is easily distinguished from it by the absence of the characteristic schizogonous bodies (KOCH'S blue bodies), by its relatively slight pathogenicity, and the ease with which it can be inoculated into susceptible animals. It is of widespread distribution and is also met with in infections due to *T. parva*, a fact which rendered experimentation with this species difficult for many years. The red corpuscles are not changed, but contrary to what takes place with *T. parva*, there must be a fairly considerable destruction of the corpuscles in certain countries and in certain seasons and under certain influences. For in fatal cases one observes very intense anaemia and corpuscular changes and jaundice, but never redwater. In British East Africa MONTGOMERY rarely found 10 per cent. of the corpuscles invaded. In Algeria SERGENT (Ed.) and LHÉRITIER observed 30 per cent. invaded in animals in apparent good health. In Morocco VELU and EYRAUD recorded in native cattle a short time before death 27 to 55 per cent. corpuscles invaded, sometimes with five parasites per corpuscle.

The parasite has been found associated with *P. bigeminum* throughout the whole of Africa, S Europe, S. Asia, and Australia. It has never been found in America, in spite of the importation of large numbers of zebus from India and Africa. It is found at high altitudes (2,400 metres at Asmara and above 2,100 metres in the Himalayas). Similar or identical species have been found in the carabao buffalo and in a number of deer and antelopes.

The piroplasm is transmitted by *R. simus*, *R. evertsi*, and more rarely by *R. appendiculatus*, but not by *Margaropus annulatus* (THEILER). The ticks become infected as nymphs and transmit the disease in the adult stage.

Brumpt failed to transmit this piroplasm in France by causing susceptible animals to be bitten by larvae of *Margaropus calcaratus* and *R. bursa* collected on native animals in Asia Minor, or by adult *Hyalomma aegyptium* transplanted from an African ox to a susceptible animal or obtained from broods of larvae and nymphs from the hedgehog. CARPANO (1915) believed that *Hyalomma aegyptium* was the intermediate host of *T. parva* and *T. mutans* in Cyrenaica. Inasmuch as the piroplasm is not passed on hereditarily through the ticks, one has to study ticks living at various stages of their development on cattle in order to ascertain the European or African transmitters of the piroplasm. *R. bursa*, and to some extent *R. sanguineus*, appear to be the most likely transmitters judging by their life history, and the appearance of the piroplasm in July in Algeria gives support to this view.

The period of incubation according to THEILER after infection with *R. appendiculatus* is from 28 to 58 days, with *R. evertsi* 29 days ; by inoculation it is much shorter, 4 to 10 days in adult animals up to the commencement of the fever, and 5 to 15 days up to the appearance of parasites. Brumpt inoculated three calves with blood from adult Tunisian cattle and parasites appeared in their blood in 14, 27 and 40 days respectively, but no clinical symptoms were seen. Fever lasts a few days and generally the animal recovers, although under certain conditions, *e.g.*, rinderpest, excessive heat, etc., immune animals may suffer from relapses and even succumb. In Asia Minor the parasite is constantly associated with *P. bigeminum* and *Anaplasma marginale*, and it appears to become pathogenic in certain conditions for some unknown reasons. In Morocco VELU and EYRAUD observed several fatal cases in adult native cattle during the very hot season, and from 52 to 55 per cent. of the blood corpuscles were found infested. Recovered animals always show the parasite in their blood.

Anaplasma marginale (THEILER 1910).

Syn. (?) *A. argentinum* LIGNIÈRES, 1914 ; *A. Theileri* CARDAMATIS, 1911.

These are in the form of spherical masses rarely attaining 0.5 microns in diameter and situated generally at the margin or near the margin of the corpuscles. Their pathogenicity was first demonstrated by THEILER, but the bodies were pointed out by SMITH and KILBORNE in 1893, who, however, considered them to be developmental stages of *P. bigeminum.* Brumpt admits that it is often impossible to distinguish morphologically a true anaplasm from Jolly bodies. A distinction between them is quite easy to make experimentally as the former become reproduced in susceptible animals after inoculation, while the latter are incapable of multiplying. The author agrees with LIGNIÈRES in this respect, and maintains that no investigator can have any doubt at the present time about the parasitic nature of the cattle anaplasms. The ox, zebu, and buffalo are infected naturally, while LIGNIÈRES showed that the sheep and goat are susceptible and presented latent infections of long duration.

The parasites are found almost everywhere associated with *P. bigeminum* and *T. mutans,* but in certain localities (in the Transvaal, Argentine, and Brazil) the anaplasms have been found in a state of purity. It would appear that the parasites are unknown in Australia but the immunity exhibited by Australian animals after importation to South Africa would tend to show that the parasite is to be found in certain parts of Australia. Cattle are known to suffer from anaplasmosis in Italy, Greece, Algeria, Tunisia, the whole of Africa, America, S. Asia, and the Transcaucasus. The parasite is demonstrated by inoculation of blood into susceptible animals, but the infection thus produced is most often a mixed infection with *A. marginale* and *A. centrale.*

The only positive experiments in tick transmission are those of THEILER. In three cases *Margaropus decoloratus* larvae raised on affected animals produced infection in 52 to 78 days. One experiment with the larvae of *R. simus* obtained from females collected on immune animals gave a positive result in 75 days. Infection is therefore hereditary. Brumpt failed to infect animals by placing on them large numbers of *Margaropus calcaratus* and *R. bursa* from Morocco, Algeria and Tunisia collected from immune animals. But larvae obtained from numerous *M. australis* females collected on immune animals in Brazil, and found capable of transmitting *P. bigeminum* and *P. argentinum,* together with *Spirochœta theileri,* did not transmit the anaplasms invariably found in the blood of the Brazilian cattle. In the United States SMITH and KILBORNE (1893) do not appear to have succeeded in transmitting "marginal points" by the agency of Margaropus, but transmission took place by inoculation of blood and the parasites were seen in animals living in the open and infected spontaneously. In South Africa, at a latitude of about 25°, anaplasmosis is seen throughout the year, but it is most common in summer. The disease reveals sometimes a latent infection due to *P. bigeminum.*

Anaplasma centrale (THEILER 1911).

This species is distinguished by its central position inside the corpuscle and by its almost complete absence of pathogenicity. But, as THEILER has shown, inoculation with *A. centrale* immunises against *A. marginale* infection. WALKER, however, showed that blood from certain animals that had harboured a pure *A. centrale* infection when inoculated a few months later into susceptible animals produced a *marginale* infection which was sometimes fatal. It is very likely, however, that the animals had become accidentally infected with *A. marginale.* Transmission takes place by *Margaropus decoloratus* (THEILER) and the period of incubation was in one case 55 days and in the second 114 days. After experimental inoculation the period of incubation is much shorter, 16—47 days. The blood of recovered animals is virulent.

Anaplasma argentinum (LIGNIÈRES, 1914).

This parasite was probably originally imported from Spain into America with cattle, and it is morphologically identical with *A. marginale.* It was discovered in Argentina by KNUTH, who, however, considered it to be a stage in the life cycle of *P. bigeminum.* LIGNIÈRES demonstrated the specificity of the parasite, which he observed in the blood in 20 to 23 days after inoculation, and like *A. marginale* it produces intense anaemia and no redwater. The parasites may infest 45 per cent. of the corpuscles in severe cases, and pure anaplasmosis produces a higher mortality than the piroplasmoses in Argentina, amounting to 50 per cent. in young animals and 95-100 per cent. in adults. According to LIGNIÈRES, jaundice is not of common occurrence and this characteristic enables one to distinguish the Argentine type of gall-sickness from the African type. The blood of recovered animals remains virulent for at least six years.

The parasite is not transmitted by *Margaropus australis,* and LIGNIÈRES incriminates a tick of the genus Amblyomma. The anaplasm can be inoculated into the sheep and goat but not into the horse, pig, and small laboratory animals. The sheep and goat develop a latent infection after inoculation of virulent blood, but blood from these animals when inoculated for even up to a year afterwards into susceptible animals produces an acute anaplasmosis. The virus can be attenuated and used as a vaccine by repeated sub-inoculations into sheep.

The author then appends some notes on two piroplasms, one observed in Canada and the other in the Gold Coast.

Piroplasma hudsonius bovis (BOWHILL, 1908). While investigating a redwater of cattle in British Columbia BOWHILL discovered in the blood of affected animals a typical piroplasm showing pear-shaped and polygonal forms, and very rarely bigeminate forms. The parasites were as a rule difficult to find. The disease caused by the piroplasm was chronic in its course and relapses occurred. Affected animals succumbed as a rule after the third attack. The tick collected on these animals would appear to be *Dermacentor venustus,* which is widespread in distribution in North America, and is the transmitter also of Rocky Mountain fever, and tick paralysis in man and sheep.

Achromaticus macfiei (C. FRANÇA, 1918). This parasite was observed by MACFIE associated with *P. bigeminum* and *T. mutans* in the blood of a cow that had died at Tamale, in the north of the Gold Coast, and it would appear to be highly virulent. The parasite assumed various forms, rounded, triangular, fusiform, amoeboid, but it differs, according to FRANÇA, from the piroplasms already described on account of the shape of its nucleus, which is always rounded and often centrally placed in the rounded forms. The mode of division also appears to be quite different from that observed in the other piroplasms.

Jaundice in Cattle in Northern Africa.

Cattle in Algeria and Tunisia are often attacked with various diseases which show in general symptoms of more or less pronounced jaundice, profound anaemia, and high fever, and sometimes redwater.

It is probable that these conditions are identical with those studied under the name of gall-sickness and other such names in South Africa. Brumpt considers that the jaundice is referable to different diseases, and in particular:

(1) Piroplasmosis due to *P. bigeminum* and transmitted by *Margaropus calcaratus*; this condition is seen throughout the year in animals imported from France, but it is especially frequent during the spring.

(2) Affections observed most often in summer and caused by *T. mutans* in immune animals. This disease is not accompanied by redwater and trypan blue proves of very little use in its treatment.

(3) Anaplasmosis. The blood of nearly all adult cattle in Northern Africa harbours *A. marginale*, which produces a disease without redwater and identical clinically with the preceding piroplasmosis.

(4) A disease recently specially described by SERGENT (Ed.) and LHÉRITIER, the etiology of which appears to be unknown and which is designated for the sake of convenience under the name haemoglobinuric biliary fever of the ox. This condition is seen in May, June, July and August, and in districts where it is enzootic the mortality is not high, rarely 2 to 5 per cent. of the total herd. On the other hand in animals recently imported from France or brought down from the higher plateaux the mortality rate may be quite considerable. It varies also in virulence in different years, and on certain farms it was noticed to occur simultaneously with *P. caballi* infection in horses, thus indicating that both affections were probably transmitted by the same species of ticks. One attack appears to confer immunity. Native animals from 1 to 2 years old were more susceptible than adults or very young animals.

The relative importance of these various gall-sicknesses would appear to depend upon whether the animals are native bred or imported, and upon the localities.

The author promises a series of reports on a number of investigations he has made upon this subject of piroplasmosis.

LEGER (A. & M.). **Piroplasme de la Civette au Senegal.** [A Piroplasm of the Civet Cat in Senegal.]—*Bull. Soc. Path. Exot.* 1920. Oct. Vol. 13. No. 8. pp. 649–652.

The authors describe a peculiar kind of small blood parasite in the Senegal civet cat (*Viverra civetta*). Blood was examined from two young animals freshly killed in the neighbourhood of Dakar. Both were infected and the parasites were classed as "rare" or "not rare." The parasite was rounded or regularly ovoid in shape and did not exceed 1 micron in diameter, often only 0·3 or 0·4 micron. The cytoplasm after staining with Giemsa or Leishman appeared azure blue and did not contain any trace of pigment. The nucleus was relatively very large and was situated peripherally, forming a bosselation which made up one-half or often two thirds of the circumference. It stained a deep garnet red colour. Sometimes a round chromatin granule could also be seen in the peripheral portion of the cytoplasm. The presence of two parasites within a single red corpuscle was only exceptionally noted. No rod-shaped element or parasite undergoing division could be seen and Maltese cross forms were entirely absent. No change was noted in the staining reaction or morphology of the corpuscles. No appearances other than those seen in the peripheral blood could be seen in smears from the organs.

The intracorpuscular parasite belongs undoubtedly to the Family Piroplasmidae and among the Carnivora (carnivorous and insectivorous) several members of this family, belonging to five different genera, have been recorded.

(1) Genus *Piroplasma.*—Large haematozoa, often pear-shaped and dividing by a process of budding: *P. canis*, found widespread over the world in dogs.

(2) Genus *Smithia.*—Included by some authors in the preceding genus, multiplication characterised by division into four elements: *S. talpae* of the Jura mole.

(3) Genus *Achromaticus.*—Also characterised by large elements but gives rise to numerous intracorpuscular merozoites: *A. gibsoni* of the Madras jackal.

(4) Genus *Rangelia.*—Created by CARINI and MACIEL in 1914, elements rounded in shape and usually arranged in pairs; schizogony takes place in the cytoplasm of connective tissue or endothelial cells in the internal organs and produces a large number (30—100) of merozoites: *R. vitali* of Brazilian dogs.

(5) Genus *Nuttallia.*—With rounded or ovoid elements in the blood corpuscles differing from the above by their very small size and the multiplication forms, which are seen in the peripheral blood, assume a Maltese cross shape: *N. herpestidis* in the Portuguese and perhaps in the Indian ichneumon, and *N. ninense* in the Tunisian and Corsican hedgehogs.

The genus *Nuttallia* can be distinguished from the genera *Theileria* and *Gonderia* by the absence of rod-shaped forms in the blood.

The parasite of the civet cat is, therefore, placed in the genus *Nuttallia.* It does not seem to be identical with the Nutallia already described in Carnivora although it certainly resembles the piroplasm of the Portuguese carnivora, but it is smaller than this piroplasm and moreover no cross-shaped or other multiplication forms were found in the blood. It would be somewhat premature to create a division of the genus *Nuttallia* for this piroplasm and in the meantime the authors propose to call it *Nuttallia civettae.*

LAVERAN (A.). **La leishmaniose canine chez la Souris.** [Canine Leishmaniasis in the Mouse.]—*Bull. Soc. Path. Exot.* 1920. Oct. Vol. 13. No. 8. pp. 680–687.

In a previous communication Laveran described the development of the leishmaniases and in particular the virus of canine leishmaniasis in the white mouse. A striking analogy was found to exist between the affections produced in this small rodent by *Leishmania donovani* of man and leishmania of canine origin. It was also shown that there were certain differences between the affections produced by the virus of kala azar on the one hand and that of oriental sore on the other. These studies have been continued and in particular the effects of the canine type of infection upon mice have been examined. Variations in virulence of the canine leishmania were noted following upon repeated sub-inoculations into mice, and, moreover, certain signs were noted by means of which one could recognise in a mouse killed in apparent good health a few months after inoculation that there had been an infection followed by recovery.

The following list gives the number of successive infections and the number of failures to infect after 1, 2, 3, 4, 5, and 6 sub-inoculations in mice. The number of infections terminating in recovery were also noted. Ninety-two mice were used in all.

1st Inoculation.—Successfully infected, 17; failure, 1; recoveries, 7.

2nd Sub-Inoculation.—Successfully inoculated, 13; failures, 2; recoveries, 8.

3rd Sub-Inoculation.—Successfully inoculated, 16; failures, 3; recoveries, 8.

4th Sub-Inoculation.—Successfully inoculated, 19; failure, 0; recoveries, 15.

5th Sub-Inoculation.—Successfully inoculated, 14; failure, 1; recoveries, 9.

6th Sub-Inoculation.—Successfully inoculated, 6; failure, 0; recoveries, 5.

The number of failures varied but little with the number of successive sub-inoculations, but the number of recoveries varied a good deal. The percentage recoveries was 38·88 for the first, 53·3 for the second, 42 for the third, 78·9 for the fourth, 60 for the fifth, and 83·33 for the sixth sub-inoculation. This high proportion of recoveries after the sixth sub-inoculation led to the loss of the virus in the laboratory. It would, therefore, appear that the canine leishmania instead of increasing in virulence when passed through the bodies of mice becomes gradually diminished in virulence for this animal.

The author records ten observations in which mice killed while they were manifesting signs of illness were found more or less markedly infected, and further twelve observations in which mice that had shown undoubted signs of affection were killed after the symptoms had disappeared or diminished and in which recovery was noted.

In the case of the infected mice the spleen was found to be markedly enlarged. The average weight of the mouse was 30·9 gramme and of the spleen 0·87 gramme (maxima 1·20, 1·25, and 1·40 gramme). Leishmania in more or less considerable numbers were found in the liver, in the spleen, and in the bone marrow and more rarely in the testicles, but these glands were often observed to be somewhat atrophied, presenting to the naked-eye quite an appreciable diminution in size, and the spermatocytes in them had more or less completely disappeared. One of these mice showed only a few leishmania in the spleen although it was still markedly enlarged and the testicles were undergoing atrophy. It is claimed that this mouse was well on the road to recovery and represented a sort of transition stage between the first group of mice and the second.

The mice that had recovered when they were post-mortemed no longer revealed any leishmania, but as a rule it was easy to obtain information with regard to a pre-existing infection. In the first place enlargement of the spleen was noted during the lifetime of the mice, and this enlargement although decreased, persisted for a certain period after the leishmania had disappeared. In twelve such mice, weighing on an average 31·16 grammes, the average weight of the spleen was 0·36 gramme, that is to say, distinctly lower than that of the spleen of the infected mice, although it was still larger than normal (6–7 cgm.). In the second place the testicles were often found to be atrophied; they were sometimes reduced to about half their normal size, their parenchyma was soft and in smears stained by Giemsa spermatocytes were absent or only rarely found, and even then they were often deformed. The testicular atrophy was sometimes more pronounced on one side than the other.

In the case of mice inoculated intraperitoneally with the virus of kala azar and post-mortemed after recovery, Laveran had previously noted that testicular atrophy was not a rare occurrence.

All his experiments were carried out on adult male white mice, which were inoculated intraperitoneally with an emulsion of triturated fragments of liver and of spleen (or of one of these organs only) obtained from mice inoculated with the canine virus. The mice were post-mortemed after a very variable interval subsequent to the inoculation (73 days to 25 months), and some of them, comprising the infected mice, were in very poor condition. These animals were killed before death would have naturally taken place, in order to obtain clear results post-mortem. From the mice killed during the course of the disease or after recovery smears were made from the liver, spleen, bone marrow, and testicles. These smears were fixed and stained with Giemsa and examined with regard to the presence or absence of leishmania, and in the case of the testicles in order to ascertain the condition of the spermatocytes.

PARROT (L.). **Spirochétose naturelle du Canard domestique.** [Naturally Occurring Spirochaetosis of the Domestic Duck.]—*Bull. Soc. Path. Exot.* 1920, Oct. Vol. 13, No. 8, pp. 647–648, With 1 fig.

Although certain avian spirochaetes, such as *Sp. anserina* Sakharoff, *Sp. gallinarum* Stephens and Christophers, have been experimentally transmitted to the duck, there does not appear to be on record any case of natural infection of this animal. Parrot describes its occurrence in ducks at MacMahon, Constantine, Algeria. The six ducks were kept in a fowl house together with one cock, six hens and 15 chickens, from three to four months old. One four-months-old duckling died after six days illness. The symptoms were dullness, loss of appetite, bile-stained diarrhoea, partial paralysis of the hind quarters. Post-mortem there was patchy fatty degeneration and hypertrophy of the liver, enlargement of the spleen, and the heart appeared pale and soft. Four days later another, three months old, duckling commenced to show the same symptoms. The blood was examined microscopically two days later and numerous spirochaetes were seen in it, 12 to 18 microns long, of variable shape, each with about 4 to 8 spiral turns, and occurring singly or in groups from 15 to 18 microns in diameter. Four days after the onset of symptoms the blood was again examined, but with negative result. The duckling recovered. A three months old chicken was inoculated into the breast muscles with ½ c.c. of the blood while it contained spirochaetes, but the chicken did not become infected. The other birds in the fowl house did not at any time before or subsequent to these dates show any signs of spirochaetosis, although numerous ticks, *Argas persicus*, could be found in the wood work. The author suggests that the causal organism be named *Spirochaeta anatis* if further observations demonstrate the existence of a special spirochaetosis of the domestic duck.

DISEASES DUE TO METAZOAN PARASITES.

PARROT (L.) & JOYEUX (Ch.). **Les cysticercoïdes de** *Tarentola mauritanica* **L. et les Ténias du chat.**—*Bull. Soc. Path. Exot.* 1920. Oct 13, Vol. 13, No. 8, pp. 687–695*.

LOPEZ NEYRA and MUNOS MEDINA have recently established the relationship between two cysticercoids of the gecko, *Tarentola mauritanica* L. and tapeworms of the cat. The present writers, working independently, are able to confirm these observations.

Dipylidium trinchesei Railliet, 1893. The first of the cysts in question has four rows of hooks, and is commonly found in the intestinal walls of *T. mauritanica* in Algeria. It has been described from Oran, from El Kantara, where 20 per cent. of the geckos were infested, and from Granada This cyst has also been observed in *Lacerta agilis* L. and in *Seps chalcides* Dum. and Bib. The authors are also of the opinion that these cysts are identical with *Cysticercus acanthotetra* Parona, 1887, from the adder, *Zamenis viridiflavus* Wagl. It has been suggested by DIAMARE (1893) that this cyst is the larval stage of *D. trinchesei* of the cat. DIAMARE's suggestion was based largely on comparison of the larval and adult scolices.

Unfortunately there are certain objections to this view. MARCHI (1878) attempted to rear the adult from this cyst in the gecko, by experimental feeding to various animals. He fed cysts to a vulture and a cat without success. However, after feeding the cysts to an owl (*Strix noctua*) he was able to observe the commencing development of the adult tapeworms in the intestine of the bird when killed for examination some days subsequent to the feeding. This experiment would not appear to be conclusive, since a Dipylidium has never been reported from *Strix noctua*, and the only members of this genus known to occur in birds are *D. avicola* Fuhrmann, 1906, from a vulture (*Gyps Gobbi*) in South Africa, and *D. columbae* Fuhr. 1908, described from a poor preserved specimen taken from an Egyptian pigeon. It may be pointed out that MARCHI only observed the initial stages of development, and there is nothing to prove that the tapeworm would have reached maturity in the owl. LOPEZ NEYRA and MUNOS MEDINA also concluded that the cyst in question was the larval stage of *D. trinchesei*, but were unable to complete the life-cycle of the worm experimentally. They made a study of the epidemiology of this worm and concluded that the facts of distribution confirmed their hypothesis.

The present authors (1920) have recently published a description of a cyst having four rows of hooks found in *T. mauritanica*. They agree with DIAMARE that the cyst is that of a Dipylidium. Its structure is very simple. Often many parasites are enclosed within the one adventitious membrane. The characters of the scolex, and in particular the hooks, are dealt with later.

In spite of the experiment of MARCHI referred to above, these workers performed the following experiment with a view to confirming their hypothesis that this cyst was the larval stage of *D. trinchesei*.

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*Abstracted by Mr. R. DAUBNEY., M.Sc., M.R.C.V.S.

On the 9th May, 1920, three kittens of the same litter were fed the following:—

Kitten 1. 8 cysts from the liver of *T. mauritanica.*
„ 2. 12 cysts from the intestinal wall of the same gecko.
„ 3. 10 cysts from the mediastinal region of the same animal.

A fourth kitten of the same litter served as control.

The animals were killed in the following order:—

Kitten 1. 7 days after feeding. No cestodes in the intestine.
„ 2. 14 days after feeding. In the first 8 in. of small intestine were found 6 young cestodes.
„ 3. 22 days after feeding. About 30 older cestodes in the intestine.
„ 4. Killed on same day as kitten 3. No cestodes.

Two kittens out of three were successfully infected, whilst a control remained free.

Cursory examination of the cestodes showed that those in kitten 2, killed 14 days after feeding, had well-formed sexual organs in their posterior segments, but the uterine capsule was not yet developed.

The cestodes of kitten 3, killed 22 days after feeding, proved to be of two species. The first of these was similar to those found in kitten 2, and was represented by about 30 individuals, in the posterior segments of which ripe eggs were discernible. The second species had only a solitary representative. The last segments of this worm contained eggs in formation, but the hooklets of the embryos were not yet visible.

The first cestode was determined as *D. trinchesei* Railliet, 1893 (Diamare, 1892). The characters given by the Italian author were easily verifiable from the specimens in question, the length alone being different. The incompletely developed specimens of the present workers measured from 30 to 50 mm. in the fresh state, and had a mean length of about 20 mm. preserved in alcohol. The worms, which contained ripe eggs, were about 60 mm. long when fresh and 20–24 mm. in alcohol. In order to make a fair comparison of these figures with those of DIAMARE, one ought to know whether this worker measured his specimens in the fresh state or in preservative, a point upon which the Italian author's text throws no light. If the latter was the case, then the measurements of the present writers agree perfectly with those of DIAMARE. DIAMARE would appear to have collected *D. trinchesei* in the intestine of a cat in Naples. He also received specimens collected by PASQUALE in Egypt. The specimens from Egypt would be most certainly preserved. No difference between the length of the Neapolitan and the Egyptian specimens was remarked, so that it would seem that the material used was preserved in each case.

The hooks are arranged in four rows and number about 80, agreeing perfectly with those of *D. trinchesei* and those of the cysts from the gecko. Measured after HENRY'S method for *T. solium,* they correspond closely with those of the cysts, and measured by the method employed by DIAMARE, the results are almost identical. The hooks have the characteristic rose-thorn shape of the Dipylidia.

The suckers are a little larger in the adult stage than in the larval forms, measuring 100–110μ in the former as against 96μ in the latter. The genital organs are exactly as described by DIAMARE. The vas deferens runs forward to the anterior portion of each segment, instead of describing a curve as in *D. caninum.* The vagina opens above the cirrus sac (below in *D. caninum*). The ovaries are globular and unbranched, whilst the uterine capsules contain each only a single egg. These characters are peculiar to *D. trinchesei*.

The authors therefore conclude that the cysticercoids of *Tarentola mauritanica* are the larval stage of *D. trinchesei*. As it has been established that cats eat these animals in Algeria and Granada, it will be readily conceded that ample opportunity occurs for the completion of the life-cycle of this cestode.

On the other hand they consider that it is possible that *D. trinchesei* is not solely confined to the cat as a definitive host. The partial success of the experiment of MARCHI in the owl may indicate that the worm is capable of development in other hosts. Equally too, the fact that *Cysticercus acanthotetra* has been found in the adder *Zamenis viridiflavus* has to be explained. Since cats do not eat snakes, it is necessary to admit either that *T. mauritanica* is the intermediate host and that those cysts occurring in *Zamenis viridiflavus* are accidental and without chance of further development, or that *D. trinchesei* may also occur in snake-eating animals which are infected in eating *Z. viridiflavus*.

Dipylidium Chyzeri, Von Ratz, 1897.—The second cestode, which had only a single example in kitten 3, is more difficult to determine. It is again a Dipylidium and measures about 250 mm. in length in the fresh state, and about 175 mm. preserved. Its stage of development agrees well with what might be expected from the date of infection. The last segments contain eggs in process of formation, in which one is as yet unable to distinguish the six larval hooks.

The hooks of the rostellum are arranged in about 15 rows and are graduated in size. They are typical Dipylidium hooks, and smaller than those of *D. trinchesei*. In their dimensions they resemble those of *D. caninum*, but of course the number of the rows is much greater. The rostellum is almost completely evaginated, sub-cylindrical, and rounded at its anterior extremity, measuring 100μ in diameter at its base and being 130μ in length. The suckers are 135 to 140μ in diameter. The scolex is about 500μ in diameter in its thickest part. The neck is moderately developed. The segments resemble those of *D. caninum*, lengthening as they ripen. The two genital pores open in the anterior part of the segments.

The genital organs develop much later than in *D. trinchesei*. The cirrus is slender, retracted in its sac, which measures about 220μ by 100μ. The vas deferens passes forward into the anterior portion of the segment without describing any curve. Testes are numerous. The vagina opens in the neighbourhood of the cirrus pouch, descends towards the posterior part of the segment and ends in a coiled seminal receptacle. The ovaries are difficult to see in total mount, but on section they appear as two globular masses surrounding the receptaculum. The vitelline glands are small. The eggs in the posterior segments are only about 30μ in diameter, and their hooks are not yet evident. Each egg is contained in a separate uterine capsule.

The characters outlined would place the worm in the genus Dipylidium, and in that group of the genus which is characterised by numerous rows of hooks. Taken as a whole, these characteristics enable the authors to determine the worm as *D. Chyzeri*, Von Ratz, 1897, found in the cat in Budapesth.

SONSINO (1897) has described a cysticercoid from the gecko, having 14 rows of characteristic rose-thorn hooks. LOPEZ NEYRA and MUNOS

MEDINA have latterly given a more complete description of this cyst. They found this form readily in the geckos of Granada, and considered it to be the intermediate stage of *D. Chyzeri*. They were able to infect cats by feeding the viscera of geckos, accompanied by the usual controls, and in an epidemiological study of *D. Chyzeri* they recorded it from 15 per cent. of the cats examined. This would indicate that *D. Chyzeri* occurs in Algeria, Spain and Budapesth.

The experiments, then, taken as a whole, well explain half of the life cycle of *D. trinchesei* and *D. Chyzeri*. There remains to be completed the infection of geckos with the larval stage, by feeding the segments of the adult worm.

LOPEZ NEYRA and MUNOS MEDINA report that they have observed the commencement of larval development of *D. trinchesei* in the gecko. They show a slowness in their development which corresponds perhaps to the hibernation of the reptile host.

A bibliography is given.

PONS (R.). **Description de deux microfilaires sanguicoles, parasites d'un oiseau (*Merganser serrator*) vivant dans des régions froides (Terre-Neuve, Anticosti, Saint-Pierre et Miquelon).** [Two Microfilariae in the Blood of the Merganser, a Diving Bird or Sea Duck living in Cold Parts (Newfoundland and Neighbourhood).]—*Bull. Soc. Path. Exot.* 1920, Oct. Vol. 13, No. 8, pp. 652–654, With 2 figs.

The merganser, commonly called locally the sawbeak, is either a sedentary or migratory bird, living by the sea shore or on ponds of salt or fresh water inhabited during the months of August and September by numerous mosquito larvae. No adult forms of the filariae were observed.

The smaller of the two embryos, which the author calls *Microfilaria legeri*, was much the more common. It was found in the blood of five out of twelve water birds examined. This embryo was sheathless and in fresh preparations exhibited slow corkscrew and lashing movements. The anterior end was refractile and rounded and somewhat preputial in form, inasmuch as the axial part could be retracted or projected rapidly. This extremity sometimes became fixed to the slide while the rest of the body exhibited motility. A slightly attenuated posterior portion ended in a very refractile prominent point.

After staining with Giemsa the body of the parasite appeared somewhat stunted, about 100 to 105 microns long by 5·5 microns broad. The anterior extremity showed two elongated peripheral chromatic spots separated by a clear space, the caudal extremity was one-sixth the length of the embryo and terminated in a nuclear spot. Two somewhat indistinct rows of cells with large nuclei were seen in the body and their continuity was interrupted in a very characteristic manner: (*a*) Just in front of the middle of the embryo there was a rounded clear space, and (*b*) the commencement of the tail, that is, the posterior sixth, was occupied by a clear space, often clover-shaped, with each lobe occupying only a part of the thickness of the parasite, and (*c*) just in front of the end of the anterior quarter there was a triangular shaped clear spot. The parasite appeared to become bent at the level of these clear spots.

The second type of embryo was only encountered on one occasion and then in very small numbers in the right jugular vein and in scrapings from the neck muscles. The embryo did not exist in the chest or abdominal blood. The embryo is called *Microfilaria guillemeti*. It was sheathless and in the fresh state it exhibited rapid wriggling movements. The rounded anterior extremity was more regularly narrowed down, commencing from the posterior fifth and terminating in a blunted point. After staining, the parasite measured 250–260 microns long and 6·5 microns broad. The anterior extremity possessed no nuclei over a distance of about 12 microns; the posterior extremity appeared clear on account of the loose arrangement of the circular chain and it terminated in a chromatin spot. The continuity of the chain of cells appeared interrupted in two or three parts, anteriorly one-third the length of the parasite from the anterior end and posteriorly about one-third from the posterior end.

CURASSON (G.). **Essai de traitement de la microfilariose du Charognard.** [Experiments in the Treatment of Microfilariasis of the Carrion Crow.]—*Bull. Soc. Path. Exot.* 1920. Oct. Vol. 13, No. 8. pp. 654–655.

Recently the author had occasion to note the presence of several adult and embryonic filariae of the domesticated and wild birds of Senegal. Some of them were obtained in sufficient numbers to undertake experiments in the treatment of the affection and in this note a short account is given of the results obtained with the carrion crow. Microfilariae were frequently found in these birds in the neighbourhood of Dakar, especially in those that lived on slaughter-house refuse. Out of 22 birds examined 14 harboured the parasites. There is every reason to think that the transmission of these parasites is easily accomplished either by the bites of the numerous mosquitos or by means of the ecto-parasites with which the birds are densely covered.

Three infected birds were treated with galyl, slowly injected in 1 per cent. solution, at the rate of ½ c.c. per kilo body weight into the axillary vein. This treatment brought about at least partial recoveries.

One bird showed numerous parasites in the blood; two hours after the first injection they were still quite as numerous, but much less active. On the following day the bird was again injected and on the next day no parasites could be seen in the blood, which remained free for nine days subsequently. Afterwards, however, the microfilariae commenced to re-appear. The bird was post-mortemed on the following day but no adult worm was discoverable. The second bird showed numerous parasites in the blood and on the day following the first injection they were still as numerous and their vitality did not seem to be affected. On the second and third day further injections were given, and on the fourth day the parasites became rare and exhibited little activity. On the fifth day the bird died accidentally and on post-mortem two adult filariae were found dead in the abdomen. There were no males and in the heart and lung blood very few dead embryos were seen.

The third bird also showed numerous embryos in the blood when first injected. The injection was repeated on the second day and on the third day no parasites could be seen in the peripheral blood. The blood remained free subsequently for 12 days and the animal was then post-mortemed. One adult female, apparently dead, was found in the abdomen.

YORKE (Warrington) & MACFIE (J. W. S.). *Strongylidae* **in Horses.** ix. *Cylicostomum tridentatum* **sp.n.**; x. **On the Genus** *Poteriostomum*, **Quiel**; xi. **Species Found in West Africa and Jamaica**; xii. *Cylindropharynx rhodesiensis* **sp.n.**; xiii. *Cylicostomum triramosum* **sp.n.**—*Ann. Trop. Med. & Parasit.* 1920, Nov. 27. Vol. 14, No. 2, pp. 153–157, 5 text figs.; pp. 159–163, 6 text figs.; pp. 165–167, 2 text figs.; pp. 169–174, 7 text figs.; and pp. 175–179, 5 text figs.*

†ix. A new moderately small species of the genus *Cylicostomum* is described from the caecum and colon of a young mule in West Africa and from a horse in Jamaica. This species is characterised by the presence of three small chitinised triangular teeth, one dorsal and two ventro-lateral, corresponding to the divisions of the oesophagus and projecting into the base of the mouth capsule. It belongs to the "*catinatum-alveatum*" group and is considered by the authors to resemble most closely *Cylicostomum alveatum*. From the latter the new species may be distinguished by its smaller size, the projection of the dorsal gutter as a tubercle, the circular opening of the mouth capsule, and the presence of chitinised teeth mentioned above. A complete diagnosis of the species is given.

x. QUIEL in 1919 described a strongyle (*Poteriostomum imparidentatum*) from the caecum and colon of horses at Donchery, which, although closely resembling a cylicostome, differed from the members of that genus in certain respects. He erected a new genus *Poteriostomum* for this worm, basing it on the fact that six of the elements of the internal leaf-crown are larger than the remainder and distinctly different in shape, and also that there are no bosses on the posterior end of the female. QUIEL called this worm *P. imparidentatum*. It was shortly afterwards described from Dutch horses by IHLE, who also created a new genus for it and named it *Hexadontostomum markusi*, and by TURNER, who described it as *Cylichnostomum zebrae* from Chapman's zebra.

The present authors point out that the structure of the bursal rays which QUIEL figured, constitutes a much sounder generic character than the variation in the length of the internal leaf-crown elements referred to by that worker. The supporting rays form two distinct groups, a ventro-lateral and a dorsal. The externo-dorsal ray arises from a common trunk with the dorsal ray, the main trunk of the dorsal ray being split only for about half its length, and the two lateral branches arising close to the margin of the external rays. This arrangement differs remarkably from that found in any hitherto described species of the genus *Cylicostomum*. On account of similar structure of the bursal rays the authors transfer *Cylichnostomum ratzii*, Kotlan, 1919, to the genus *Poteriostomum*, although the elements of the internal leaf-crown are all of the same size and shape.

Accepting this generic diagnosis Yorke and Macfie include the following species in this genus—

Poteriostomum imparidentatum, Quiel, 1919. Syn. *Hexodontostomum markusi*, Ihle, 1920. *Cylichnostomum* zebrae, Turner, 1920.
Poteriostomum pluridentatum, Quiel, 1919.

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*For titles of previous papers of this series see this *Bulletin*, 1918. Vol. 6. pp. 135 & 269; and 1919. Vol. 7. pp. 115 & 281.

†Abstracted by Mr. R. DAUBNEY, M.Sc., M.R.C.V.S.

Poteriostomum ratzii (Kotlan, 1919), Yorke & Macfie, 1920. Syn. *Cylichnostomum ratzii*, Kotlan, 1919.

Possibly *Cylicostomum ultrajectinum*, Ihle, 1920, based on the description of a single female, should be included in this genus.

A key to the species of the genus is appended and the authors give a bibliography of the literature relating to these forms.

xi. This is a list of species found in horses and mules in the localities referred to.

A new variety of *Cylicostomum catinatum* is described from the caecum and colon of a horse in West Africa. The worm is identical with *C. catinatum*, with the exception of certain characters of the appendages of the genital cone. These appendages are long and finger-like in the new variety and the author's figure shows that they differ markedly from those of C. *catinatum* as figured by Looss. The authors propose the name *Cylicostomum catinatum* var. *litoraureum* for the new variety.

xii. A species of the genus *Cylindropharynx* from the large intestine of the zebra (*Equus burchelli*) shot in N. Rhodesia. This species is differentiated from the other two members of the genus mainly by its large size. It is roughly twice the length of either of the other species. There are, however, other minor differences and a key to the three species is given.

xiii. A new species from the intestine of a zebra (*Equus burchelli*) shot in N. Rhodesia. This is a medium-sized species closely resembling *Cylicostomum radiatum*, but distinguished from it by the prominence of the lateral head papillae, and by the dorsal ray being three branches. The genital appendages of the male are also different from those of *C. radiatum*. One male and one female only were found.

HODGKINS (J. R.). **Presence of** *Gastrophilus equi* **in the Dog.**—*Vet. Jl.* 1920, Nov. Vol. 76, No. 11. pp. 417–418.

While under treatment for paralysis of the hind quarters due to stercoremia three larvae of the above oestridae were vomited up by an eighteen months old terrier. Two of the larvae were mature, and one was much smaller. It was probable that they had been ingested by the dog, although there was no history of its having been fed with material that could have contained these larvae.

BACTERIAL DISEASES.

SHEATHER (A. L.). **Bovine Lymphangitis.**—*Jl. Comp. Path. & Therap.* 1920, Sept. Vol. 33, Pt. 3. pp. 158–185. With 10 figs.

The available literature on this subject is first reviewed. NOCARD (1888) examined specimens received in France from Guadeloupe and isolated from the pus and preserved tissues a streptothrix which was regarded as the causal organism. The disease was of a very chronic nature, starting on the limbs and spreading to the belly, with cording of the lymphatics and enlargement of the glands. The rabbit was resistant to inoculation. In the guinea-pig intraperitoneal or intravenous inoculation caused death in from 9 to 20 days and produced lesions resembling those of miliary tuberculosis; subcutaneous inoculation led simply to abscess formation at the seat of inoculation with involvement of adjacent glands.

VRYBURG (1907) next studied a very chronic form of bovine lymphangitis in Sumatra, characterised by the development of abscesses in the skin, connective tissue, lymphatic vessels, and glands. Cases of the disease were usually sporadic but occasionally actual outbreaks were observed, which were spread out over long periods. From the pus a small Gram-negative bacillus was isolated in pure culture which was difficult to recognise in the pus on microscopic examination. Inoculation of cattle with cultures produced local lesions and abscess formation in the lymphatic glands and recovery took place in three months. Guinea pigs inoculated subcutaneously developed local abscesses in about three weeks. Intraperitoneal inoculation produced purulent orchitis and death in about two months.

Lymphangitis of cattle in India has been investigated by RAYMOND (1906—1909) and HOLMES (1907—1908), and it would appear that both these workers were dealing with the same outbreak. RAYMOND carried out his work with animals handed over to him for the purpose and HOLMES with materials taken by him in Calcutta and examined at the Muktesar Laboratory. The disease studied did not differ clinically in any material respect from that described by NOCARD and VRYBURG. In the majority of cases the infection originated from a wound of the neck or hump but in one case (as in most of NOCARD's cases) infection seemed to have gained access through a wound in the foot. The affected glands had thick fibrous capsules and in extreme cases the capsules were filled with thick yellow caseous pus and in other cases they contained a number of small encapsuled abscesses. In advanced cases these abscesses were found in the lungs and bronchial glands.

The results of these two workers' bacteriological examination were markedly discordant. HOLMES stated that in every specimen of pus he examined he found granules resembling those of actinomycosis. These masses when examined microsopically after staining by Gram or Gram-Weigert were found to consist of a dense collection of small cocci identical in appearance with the spores of actinomycosis, closely interwoven with thin branching filaments. Sheather maintains, however, that it is very difficult from HOLMES' description to get a clear idea of the appearance of the organism. Cultures were obtained in about 5 per cent. of the tubes inoculated and the cultivated organism resembled morphologically the organism found in the lesions. Guinea pigs inoculated subcutaneously with pus from lesions in cattle developed local abscesses only which showed no tendency to burst. Cultures made from these lesions and inoculated into "small animals" produced death in from 2 to 7 days. Two bulls inoculated subcutaneously and two intraperitoneally with pus emulsion failed to react but these animals were kept under observation for less than a month.

RAYMOND, on the other hand, after taking some trouble to exclude contamination, succeeded in isolating a small bacillus which he considered to be the cause of the disease. These stained by Gram-Weigert but not by Gram. It was non-motile, strictly aerobic, and grew slowly in artificial cultures. Five strains of the bacillus were isolated both direct from the natural lesions and after passage of the original pus through guinea-pigs, and the disease was reproduced in calves with the cultures obtained. Guinea-pigs inoculated almost invariably showed suppurative orchitis and abscesses in the omentum and mesenteric glands.

The material used by Sheather in his investigations comprised specimens from four cases received from Madras (from WARE, F., Supt. C.V.D.) : (1) Abscess removed surgically from hip of bull calf and two bottles of pus from the enlarged precrural gland ; (2) pus from abscess on slaughter of six-year-old cow which had had suppuration of one precrural gland some time previously ; (3) pus from prescapular gland of three-year-old bull ; both prescapular and precrural glands had been opened previously, preserved left prescapular gland also received ; (4) pus from abscess in left popliteal gland of five-year-old cow ; pharyngeal and precrural glands from this animal were also enlarged and indurated. It seems that the materials from these cases, with the exception of Case (3), were contaminated on arrival. Numbers of rabbits, guinea-pigs, and cattle were inoculated with each of these products, with the exception of that from Case (2), which was heavily contaminated, immediately after they had been received ; attempts to obtain the causal organism from the original pus were not considered satisfactory.

Rabbits proved refractory to the effects of inoculation. For example, eight rabbits, inoculated some subcutaneously and some intraperitoneally from Case (3), were kept under observation for six months and remained healthy during this period; swellings developing into local abscesses, which burst and healed, followed subcutaneous inoculation with material from Cases (1) and (4).

In guinea-pigs the most striking feature was the development of a purulent orchitis in a very large percentage of animals inoculated intraperitoneally. Slight local lesions developed in some of those inoculated subcutaneously.

Susceptible cattle inoculated subcutaneously developed a local lesion with involvement of the nearest lymphatic gland. Six hill bulls were inoculated from Case (1). These all developed local lesions with transient enlargement of the neighbouring prescapular gland. In only one of these animals was there evidence of persistent infection. For testing the materials from Cases (3) and (4) plains bulls were obtained specially, but it would appear that the resistance of these animals was about as great as that of the hill animals. The subcutaneous method of inoculation was the only method of infection employed for cattle.

A number of animal experiments were then carried out with materials other than the original specimens of pus. A broth culture was made from the testicular lesion of a guinea-pig inoculated intraperitoneally with pus from the first, original, case. Sub-cultures from this reproduced the same lesions upon inoculation into guinea-pigs.

Again, pus was withdrawn from the local abscesses that developed on the calves inoculated with material from Cases (3) and (4). The majority of these guinea-pigs developed a purulent orchitis. All the guinea-pigs inoculated intraperitoneally with culture derived from the pus withdrawn from the glands of two of these calves developed a purulent orchitis, together with abdominal lesions. Six calves inoculated with culture all developed more or less pronounced local lesions, with glandular involvement. The condition so produced resembled the natural disease in that the lesion developed very slowly and the suppurating glands showed little tendency to burst spontaneously. There was no rise of temperature and the animal showed no disturbance of health. Guinea-pigs again inoculated with culture derived from the testicular lesion of a guinea-pig inoculated with pus from the local lesion of a calf developed purulent orchitis.

"From the constancy of the lesions produced with materials from both batches of specimens it would appear that the organism which has been isolated from both is actually the cause of the original disease."

Primary cultures, whether from natural or experimental lesions, grew slowly and were scanty. This is considered to be in agreement with the fact that it was generally impossible to discover the bacilli in the pus by means of the microscope, and with the escape from infection of a certain proportion of the animals inoculated. Serum-glycerine-broth appeared to be the best medium for primary culture and usually there is a considerable multiplication of the bacilli by the third or fourth day. The organism also grows in primary culture on serum-glycerine-agar, but growth is slow and usually not visible by the fourth day.

Sub-cultures in serum-broth or serum-glycerine-broth. After 4 days incubation, a small amount of white flocculent deposit was obtained at the bottom of the tubes only in from one-third to half the tubes inoculated: a coherent surface scum begins to form about the third day.

In primary cultures on serum-agar or serum-glycerine-agar the organism develops small round translucent colonies, colourless by transmitted light, and slightly whitish by reflected light. These colonies are generally invisible to the naked eye until after the second 24 hours. In sub-cultures the growth takes the form of a continuous layer, slightly yellowish by transmitted light and white by reflected light. On neutral red agar the growth acquires a strawberry pink colour. No growth on potato, milk not coagulated, no indol formation.

Stains by any of the simple aniline dyes, but not "fast" to Gram, Gram-Weigert or Claudius. Good preparations were obtained with diluted carbol-fuchsin, and carbol gentian violet, followed by 1 per cent. acetic acid, which could be left to act for a minute or more without appreciably decolourising the bacilli.

As regards morphology the organism as it occurred in the pus from natural lesions, where it was found after some difficulty in some cases took the form of a small bacillus occuring singly or in small groups. It measured from 2–5μ long by 0·3 to 0·6μ broad. The majority did not stain evenly; some showed a speck at each end with a colourless central part, while others presented a distinctly beaded appearance.

In culture the bacillus varied in shape according to the nature of the medium and age of the culture. In the sediment of a 24 hour broth culture it took the form of long filaments intricately twisted and coiled together. Some of these stained faintly and were only slightly beaded. In others the beading was distinct, while in others there was clear segmentation into bacilli. Even after 24 hours incubation what appeared to be involution forms were discoverable. Some of the filaments had rounded swollen ends and some of the bacilli were large and spindle-shaped. A portion of the culture was composed of separate bacilli resembling those found in the pus.

A 24 hour growth on serum-agar or serum-glycerine-agar consisted mostly of separate bacilli; a small number of filaments were usually discoverable, not more than 30–40μ in length. Individual bacilli varied considerably in size. Granular as distinct from beaded forms were sometimes found in these preparations.

After further incubation, changes in the morphology of the bacillus became very marked, and after 120 hours (in serum-broth culture) regular filaments had practically disappeared. The growth was then almost entirely composed of bacilli showing great variation in shape and size.

The organism described in the present paper is stated to agree in the majority of its characters with those described by VRYBURG and RAYMOND.

It would thus appear that there are at least two distinct forms of bovine lymphangitis, one caused by a streptothrix (NOCARD), and the other by a bacillus (VRYBURG, RAYMOND, and SHEATHER).

" The bacillus does not appear to agree in all its characters with any of the pus producing bacilli hitherto described [except that very little difference seems to exist between it and *Bacillus pyogenes,* which has been described as a frequent cause of suppuration in cattle and also in pigs, especially in America.—ED.] It approximates most closely to the Preisz-Nocard bacillus, but differs from that organism in being Gram-negative."

NÈGRE (L.) & BOQUET (A.). **Sérothérapie d'une Affection Mycosique Chronique. (Lymphangite épizootique des solipèdes.)** [Serum Therapy of Epizootic Lymphangitis.]—*Rev. Gén. Méd. Vét.* 1920. Sept. 15—Oct. 15. Vol. 29. Nos. 345–346. pp. 477–483.

These authors furnish still one more contribution to their already considerable study of this affection. In 1917 they carried out a few experiments upon treatment by means of an anti-yeast serum obtained by injecting a sheep with increasing doses of a non-pathogenic yeast (*Saccharomyces ellipsoideus*), [*see* this *Bulletin* 1919, Vol. 7, No. 2, p. 78.] The work was unfortunately interrupted, but some interesting results were obtained. However, one of the horses treated by the injection of large doses (40—80 c.c.) of this serum, repeated every two or three days, lost condition to such an extent after a week that it had to be slaughtered, although at first the lesions showed some improvement.

LATOUR recently has claimed to have had good results with a number of affected animals treated by means of serum obtained from the recovered horses. The number of recoveries were said to exceed 75 per cent., and large doses, 150 c.c. every four or five days, injected subcutaneously, were recommended.

The results obtained by Nègre and Boquet with anti-cryptococcic serum, published in this paper, do not confirm in their entirety the conclusions of this author. Indeed, they maintain that several years' work upon this affection has not yet enabled them to find out the heroic remedy, which some claim to have discovered so often. The authors had the advantage of being able to study the infection particularly well on account of the methods they have devised for cultivating the organism and so obtaining quantities of culture to work with. They claim nevertheless to have cured a satisfactory proportion of severely affected horses by means of so-called pyo-therapy and experiments in progress encouraged them to believe that an effective method of immunisation may yet be obtained. The results obtained during their work are, moreover, of considerable general interest.

Having at hand considerable quantities of culture they attempted to manufacture a specific anti-serum by hyperimmunising a horse.

The technique adopted was that employed by BORREL in the preparation of anti-sheep pox serum. A horse that had recovered from ulcerative lymphangitis but had never shown any symptom of epizootic lymphangitis was submitted over a period covering 118 days to 11 subcutaneous injections, first of small doses (0·05 gramme) of dead culture, ending up with large doses (4 grammes) of living culture. The horse was bled a fortnight after the last injection. The inoculations produced large swellings and abscesses which opened up in from the sixth to the tenth day and cicatrised in a few days after having discharged pus copiously. Each injection was followed by a thermal reaction which reached up to 30° C. when doses of 3 to 4 grammes were given. The fever commenced a few hours after the injection and lasted up to the end of the third day. During the course of the fever the animal's condition became markedly affected and it was dull, depressed, weak and had no appetite. Although the lesions of ulcerative lymphangitis had completely cicatrised increased pain and tenderness were noted on their site 24 to 48 hours after inoculation, but this disappeared very rapidly. On about the twenty-fourth day of the treatment the animal accidently developed a suppurative condition of the foot which disappeared, however, in two or three days.

Injections of large doses (25—40 c.c.) of the anti-serum thus obtained, repeated at intervals of from 24 to 48 hours into affected animals, brought about during the first few days of treatment an improvement followed by a distinct aggravation of the symptoms and lesions, which was manifested by the appearance of fresh ulcers and increase in the amount of suppuration. The serum tended to cause the rapid disappearance of the buds and set up to the same degree as the corresponding antigen, a marked inflammatory reaction at the seat of the lesions [*see* this *Bulletin* 1919. Vol. 7. No. 4, p. 228.] The serum, however, was quite incapable of arresting the course of the infection, which continued to progress.

Three horses that were very severely affected were treated by this means. One died during the treatment and the condition of the other two continued to become worse so that the injections were discontinued.

Inasmuch as the serum acted very much in the same way as antigen the treatment was modified somewhat on the remaining two horses. Small increasing doses were employed instead of the large doses and injected intravenously instead of subcutaneously. One of the two animals which had been affected for several months showed extensive lesions in the form of large ulcers causing total loss of skin over the right hind leg and it showed symptoms of general intoxication due to the invasion of the exposed parts with secondary organisms. It was killed on the point of death, after three weeks of fruitless attempts at treatment.

The third horse had been affected for nearly 10 months and showed generalised lesions that were continually extending. All methods of treatment had failed, and the horse was deemed to be incurable, when it was submitted to the following treatment. First day 1 c.c., second day 2 c.c., fourth day 5 c.c., eight day 10 c.c., fifteenth day 12 c.c., twenty-fifth day 12 c.c., and thirty-second day 15 c.c., intravenously. During the first 24 hours after injection there was increased suppuration, and fresh buds appeared which developed a fluctuating consistency after 24 hours and discharged. After the third day the indurated mass, of about the size of a fist situated on the side of the neck, and the corded lymphatics commenced to disappear. The cryptococci disappeared gradually from the pus, and cicatrisation of ulcers which were several months old took place with surprising rapidity. Six weeks after the commencement of treatment the horse was in excellent general condition; there was almost no suppuration, small ulcers 1 to 2 cm. in diameter became cicatrised, and large granulating areas, about the size of the hand, showed a clean surface which was being gradually covered over with epidermis.

Although numerous methods have been tried by the authors, none appear to have been so encouraging as this method. They compare the focal reactions obtained, after the injection of serum in this condition, with those already remarked upon by LAVERDE and CARRASQUILLA in the treatment of leprosy by means of the specific serum. METCHNIKOFF and BESREDKA studied these phenomena and found that the results were not due to the products formed by the leprosy bacillus in the sera but to the cytotoxins contained in these sera.

CURASSON (G.). **Au sujet du traitement de la lymphangite épizootique.** [Treatment of Epizootic Lymphangitis.]—*Bull. Soc. Path. Exot.* 1920. Oct. Vol. 13, No. 8. pp. 640–644.

The writer claims to have had considerable experience in the treatment of this disease in Morocco, in France during the war, and in French West Africa, and in this short article he summarises the results obtained in his hands after employing the various recognised methods of treatment.

Cauterisation.—This old method appears to have given the best results, whether employed to open and cauterise the buds or to excise the corded lymphatics. It has certain disadvantages especially inasmuch as a good deal of damage may be caused to the tissues when lesions of considerable extent have to be dealt with, or when they are situated immediately overlying a bone.

Potassium Iodide.—This appears also to have given excellent results, but treatment is often very prolonged and costly. After having phlebitis set up in two cases as a result of treatment the author has now abandoned the method.

Galyl.—This drug was used in about ten cases in the same dose as recommended by DOUVILLE and his co-workers. Out of two severe cases one recovered after three injections without any local treatment other than opening up and cleansing the buds; the second case developed a generalised infection. All the other cases appear to owe their recovery more to the application of the cautery; this was adopted after the second injection inasmuch as no improvement seemed to have taken place.

Pyotherapy.—Pyo-vaccine, made up in the manner described by VELU [see this *Bulletin* 1918. Vol. 6, No. 1, p. 14.] was employed in 14 cases, a number adjudged to be insufficient to form a just estimation of its effects. However, the author seems to think that the surgical or medical treatment, which is always applied simultaneously, acts quite as effectively by itself. Perhaps, he thinks, this may be attributable to the fact that his cases were treated in the French Soudan or Senegal, where the disease appears to run a special course.

Biniodide of Mercury.—KAYSER specially recommends intramuscular injections of biniodide of mercury (dissolved in a solution of potassium iodide and injected into the muscles of the croup), while at the same time the abscesses are opened and cleansed and sprinkled with powdered biniodide. The treatment would appear to give good results even during the rainy season. The author tested this mode of treatment by taking four horses showing lesions of about the same degree of severity, and injecting two of them with the biniodide solution while the other two were treated simply by the local application of biniodide. After an interval of ten days the latter two horses showed appreciable improvement and gradually recovered. The former two horses, after ten injections covering a period of a month, remained in the same condition. This would indicate that the biniodide is effective when applied locally, but of no account when injected intramuscularly.

Sodium Hypochlorite.—In three cases in which the lesions affected the lower parts of the limbs Dakin's solution was applied by continuous irrigation. The treatment was abandoned in from 15 to 18 days, on account of its inefficacy.

Perchloride of Iron.—On account of the encouraging results obtained in human medicine in the treatment of skin lesions, showing similar appearances, the author experimented with this drug upon four recently affected cases. The treatment resolved itself in fact into a cauterisation, which is less severe than that obtained by the actual cautery. The buds were opened and cleansed, and the walls rubbed with a piece of cotton wool soaked in the officinal solution. A brownish crust formed which at first was very adherent, but became detached on the second and third day owing to the formation of pus underneath it. After the third or fourth application the cavity changed in appearance, and its walls became finely granulating, smooth and regular. The treatment, it is said, can be left off at this point and the cavity cleansed simply in the ordinary manner, after which it rapidly becomes cicatrised.

Mercuric Iodide in the Nascent State.—After opening up and cleansing the lesion the cavity is rubbed over with tincture of iodine, a thin layer of double mercury ointment applied, and again rubbed over with tincture of iodine. Mercuric iodide in the nascent state is thus formed which acts as an antiseptic and counter-irritant. This method was utilised in about ten cases of moderate severity; it failed in four cases.

Some native methods of treatment.—Some of these are worth considering. The Bambara tribe wash out the opened abscess with an astringent decoction made from the leaves of a plant known as Sahe (a shrub of the leguminosæ order) and then apply a blistering ointment made from a mixture of butter and spice obtained from the latex of the large Euphorbia, or of *Calotropis procera* or *gigantea*, or even the dried-up and powdered leaves of these plants. At other times the latex is simply mixed with milk.

A red-hot iron is largely employed. In the Sahel district the Moors cleanse the lesions with fermented camel urine, which being strongly ammoniacal is a good detergent, and then apply a mixture of salt and crushed onions, or butter and natron. They also often employ the hot iron treatment. In the southern part of the district they use with some degree of success a powder obtained by crushing blue antimony salt, which is found in certain mountains in the Nioro area.

The Toucouleurs tribe recognise the disease as being contagious, and isolate the affected animal and treat it by the application of the hot iron and hyena manure.

In Senegal the natives utilise sea baths and highly astringent preparations, such as the powdered bark of species of lemon tree.

Dubois (Charles). **Essai de vaccinations simultanées chez le mouton contre le charbon et la clavelée.** [Vaccination of Sheep against Anthrax and Sheep-pox simultaneously.]—*Rev. Gén. Méd. Vet.* 1920. Sept. 15—Oct. 15. Vol. 29. Nos. 345-346, pp. 483-416.

The author's observations were made in the south of France in a district where apparently it is necessary to vaccinate sheep against both the above affections. Usually the two operations are performed one after the other, and an interval of several months is allowed to elapse between them. It would be an obvious advantage if these two operations could be performed at the same time. Sheep were taken from a farm where neither sheep-pox nor anthrax had been observed, and they were of a breed known to be highly susceptible to both diseases. The sensitised anti-sheep-pox vaccine of the Pasteur Institute of Algiers and the anti-anthrax vaccine of the Pasteur Institute, Paris, were employed. Six sheep each received simultaneously (1) inside the thigh, ⅛th c.c. of a first anti-anthrax vaccine; (2) just behind the elbow, ⅕th c.c. of the sheep-pox vaccine. Besides these, two sheep were inoculated, one with sheep-pox vaccine alone and the other with first anti-anthrax vaccine alone. The six sheep treated with both vaccines and the control sheep treated with sheep-pox vaccine alone showed, during the next few days, local and general reactions similar to those usually seen after sheep-pox vaccination has been undertaken alone. Eleven days after the first inoculation the anthrax vaccination was repeated, using the second Pasteur vaccine. At this time the animals were all in a satisfactory state of health.

Thirty-six days after the first injection the author endeavoured to find out whether there were any specific sensitising substances in the bloods of the inoculated animals. The control sheep treated with anthrax vaccines alone showed distinct though not complete deviation of the complement. The control sheep treated with sheep-pox vaccine showed marked deviation (presumably with sheep-pox material as antigen), and the sheep treated simultaneously with both anti-anthrax and anti-sheep-pox vaccines gave a positive, though slight, reaction towards sheep-pox and a more marked one towards anthrax culture.

The animals were then tested as to their immunity against sheep-pox. Forty days after the vaccination the skin of the chest was shaved and scarified, and sheep-pox material from an affected animal was applied. The six sheep that had been vaccinated with both vaccines and the sheep vaccinated with sheep-pox vaccine alone remained quite healthy. On the other hand, two sheep that had not been vaccinated, but were of the same age, breed and origin as the vaccinated ones, became affected with a very severe generalised form of sheep-pox, and one of them died.

The vaccinated animals were next tested as regards their resistance towards anthrax. 2 c.c. of a three-day broth culture, certainly fatal for susceptible sheep, were inoculated subcutaneously, 44 days after the injection of the second anthrax vaccine. Two control sheep, as before, were inoculated, and they died in three and six days respectively. The control sheep vaccinated against anthrax only likewise died in five days, indicating, it is said, that the test inoculation was excessively severe. Out of the six sheep vaccinated against the two diseases one only succumbed to anthrax, after six days. The other five remained healthy.

These results would appear to indicate that animals can be satisfactorily immunised simultaneously against the two different affections. [A conclusion which has certainly not the merit of novelty—ED.]

DISEASES DUE TO FILTERABLE VIRUSES.

REVUE GÉNÉRALE DE MÉDECINE VÉTÉRINAIRE. 1920, Nov. 15. Vol. 29. No. 347, pp. 577-583. **La Peste Bovine en Belgique.** [Rinderpest in Belgium.]

Rinderpest, which had not appeared in Western Europe since 1870, was inadvertently discovered in Belgium at the beginning of the month of August, 1920. The French Government learnt indirectly that several suspected centres had come to notice during the month of July, and inquiry revealed the following facts. At the end of June a cargo of zebus was dispatched from British India and touched at Antwerp on its way to Rio de Janeiro. The animals were unloaded in order to be transhipped into another vessel, and in the meantime were placed in quarantine depots. Several died, but it seems that no post-mortem examination was made; and at all events rinderpest was not suspected in spite of the origin of the cargo. The survivors were shipped on the 6th July, and sailed for Lisbon and Rio de Janeiro. On the 30th June and the 3rd and 6th July three cattle boats sent from Baltimore and New York for the feeding of the Belgian population also disembarked at Antwerp. The animals were all destined for immediate human consumption, and were almost all immediately placed on rail to be sent to the slaughterhouses. A few hundred only remained for one or two days in the quarantine depots, which were probably not disinfected. Infected animals were thus despatched to various distributing centres, such as Ghent and Namur, but the majority of these were slaughtered immediately, before symptoms were manifested. However, the slaughter of a few small lots was deferred, and among these the first cases of rinderpest appeared. Towards the 10th July, out of 94 oxen received at the Ghent abattoir, 17 affected ones had to be urgently slaughtered, while three more succumbed. The same occurrences were noted at Anderlecht and Namur, but up to this point, however, the malady had only appeared in the slaughterhouse; both sick and affected animals were destined for slaughter, and naturally the affected ones were hurriedly killed. Probably the danger would have disappeared before its presence had been suspected if one unfortunate incident had not supervened. Whilst the disease was breaking out in the Ghent abattoir a batch of cattle sent by the Germans for reparation was unloaded for distribution, and some of these animals became infected. These infected animals were scattered throughout the country, and it was by this means that the disease was spread.

Attention had been drawn to the severe forms of illness observed, especially at Ghent, but rinderpest was not suspected. No case had been noted at Antwerp, where the cattle had remained for some time, and it was only later that the zebus were suspected. It seems that the first suspected cases were attributed to a malignant form of foot-and-mouth disease, and it was only about the 20th July that rinderpest was incriminated. A Commission composed of BORDET, GRÁTIA and LIÉNAUX investigated the disease; cattle inoculated with filtered urine and then with blood developed typical symptoms and lesions of rinderpest and died. The French Authorities became informed indirectly of the above facts on the 5th August, and the frontier was closed against importation of animals and animal products on that day, and appropriate sanitary police measures were organised along the frontier. On the 6th August the Belgian Ministry of Agriculture had cognisance of 40 separate centres of the disease. The situation became very serious; the disease spread very slowly, but it was found that it might assume quite a different character after a preliminary period for acclimatisation. Besides, it was anticipated that the disease might possibly be introduced indirectly on account of the large amount of commercial traffic across the frontier. Not only was it necessary to adopt measures on the frontier, it was also necessary to form a wide protective zone along the frontier. A census was taken of all cattle, sheep and goats throughout this zone and all movements of animals were forbidden, except when they were destined for immediate slaughter.

The French Government then arranged with the Belgian Ministry of Agriculture for the installation of a Serum Station at Brussels, and a considerable sum of money was voted for this purpose. This Station was located in one of the annexes of the Veterinary School at Cureghem, and its operations were supervised by NICOLAS and RINJARD. Not only did the French Commission succeed in producing in two months a sufficient quantity of serum, but it also obtained experimental results of considerable importance. Its work was followed by Commissions from other European countries.

The course of the Belgian outbreak presented some very interesting features. During the first fortnight of August fresh outbreaks were noted on an average on ten farms each day. By the 15th August 58 communes and 130 farms were reported affected, and 1,068 cattle had died or were slaughtered. From this time onwards the progress of the disease became retarded. From the 16th to the 31st, 69 more farms were found to be infected in all; that is, slightly over four per day. During September the state of affairs showed continued improvement; 25 more farms were found to be affected during the first fortnight. An invasion into French territory was feared as it was possible for the disease to extend from the centres situated near the frontier. One case in fact was suspected in the Lille district, but investigation proved that it was merely a typical form of malignant catarrh. In October the improvement became still more marked and four centres only remained in Belgium. On the 18th October the severe preventive measures ordained in France were largely relaxed. It was thereafter hoped that the plague would be limited to Belgium and that France would escape.

The most recent centre of the disease was detected near Liège on 16th November. [From that date up to 15th December no further case of the disease was observed.—ED.] At all events a sufficient supply of serum is at hand to limit losses from the disease and arrest its spread from primary centres of infection. The Belgian Sanitary

Service expressed from the commencement an optimism which subsequent events have justified. The measures undertaken consisted in rigorous isolation of the infected farms with slaughter of all affected and in-contact animals; burial after superficial disinfection of the infected and in-contacts showing fever; despatch to cold storage and for human consumption of meat from in-contacts exhibiting no fever, and thorough disinfection of the affected place. Moreover, enquiry revealed that the creation of new centres was ascribable in nearly every instance to the accidental or fraudulent movement of in-contact animals, and in a few other cases to the transportation of fresh meat. On the other hand none of them could be attributed to the very indirect modes of contagion described in all the classical references. Living intermediaries such as man or insusceptible animals played quite an insignificant or no part. Some exact observations showed that flies do not transport the virus.

The comparative mildness of the disease in Belgium is then discussed. The first theory that comes to mind is that the virus, departing from the zebu, an animal which is normally very resistant, was attenuated and only slightly virulent. This view, however, would seem to be controverted for two reasons. In the first place successive passages accidentally brought about by in-contact animals did not determine any aggravation in the epizootiological character of the outbreak; on the contrary the progress of the disease became regularly less and less. Secondly, experimental inoculation of the virus obtained from the first affected animals set up rapidly fatal types of disease which ended within the minimum periods usually accepted. It would appear that rinderpest is not nearly so formidable as one was at one time inclined to think it to be. Four more outbreaks were observed, almost without exception subsequent to military campaigns or in countries where the adoption of sanitary measures is met with difficulties of various kinds. The rapid diffusion of the disease in countries subjected to an enemy invasion is readily understandable as the disease is disseminated by the uncontrolled movement of animals, while the progressive invasion of a country where sanitary measures become difficult or impossible to apply may be explained in the same way. The persistence of the disease in Egypt and India and the outbreaks on the African Continent are easily explained.

On the other hand, rinderpest can be effectively combated among nations that possess a suitable and sufficient sanitary organization. The 1865 outbreak was stamped out without much difficulty in the north of France by the adoption of well planned, though improvised, measures. The spread of the disease in England at that time can be attributed to the total absence of a co-ordinated sanitary service. It is stated that the experience gained in this 1920 European outbreak is re-assuring, for it demonstrates the absolute efficacy of the classical methods of prevention in a country that possesses a veterinary organisation. Nevertheless, the terror inspired by the plague among the human population is a potent factor, for thereby severe measures can be framed without much resistance, as the interested parties become aroused to such a degree by the fear of contagion that one here obtains their collaboration—a condition which is indispensable for any mode of intervention to be effective.

MISCELLANEOUS.

CURSON (H. H.). **Saria.**—*Vet. Jl.* 1920. Nov. Vol. 76. No. 11, pp. 405–412. With 3 figs.

Saria is a name applied by the Wankonde, that is, the natives of Unkonde, the country situated at the northern end of Lake Nyassa, in the district of New Langenburg, to a peculiar chronic eczematous condition affecting their cattle, apparently different in many respects from other forms of tropical dermatitis. In the affected region the cattle are usually taken out to graze early in the morning and are brought back to be milked at midday. They then return to the veld and are fetched back again in the evening. At night they are housed in the same dwelling as the owner, who takes great care of his stock, providing bedding for them during the wet season, bringing them in during a storm, and usually pulling ticks off their bodies.

The cause of the disease was not definitely ascertained; cocci, and in a few cases, organisms resembling the necrosis bacillus, were seen in the serous exudate and affected skin area. Cattle with unpigmented skin seemed predisposed to attack, but calves and young stock up to three years old were seldom seen affected. Bulls also seemed to be very rarely attacked. It is noted that the affected cattle were kept at nights in smoke-filled houses. A large number of cattle belonging to other tribes, such as the Wanyika, who kept their cattle out of doors, were examined and were found not attacked. The condition also seems to be associated with good milking characteristics, and the natives even seem to exhibit a preference for Saria animals on this account.

The author quotes as examples of dermatitis affecting non-pigmented skin the following:—

(*a*) Extreme heat of the sun, which is said to cause dermatitis in white pigs in the Karroo. However, the Saria districts are situated at a fairly high altitude, 1,700-5,000 ft., and the climate is said to be temperate and more pleasant than in parts of the Karroo.

(*b*) Fagopyrismus or buckwheat poisoning.

(*c*) Trefoil dermatitis. [See this *Bulletin*, 1916, Vol. 4, No. 2, p. 73].

(*d*) Clover dermatitis.

(*e*) St. John's Wort dermatitis. [See this *Bulletin*, 1920, Vol. 8, No. 3, p. 258].

(*f*) Geeldikkop in sheep in South Africa [see this *Bulletin*, 1920, Vol. 8, No. 4, p 338].

(*g*) Vuurziekte (Dutch for fire sickness) a dermatitis affecting sheep, goats, or cattle in South Africa when in poor condition and suffering from wire worm infection.

The Unkonde veld was "sweet" and contained a large proportion of leguminous plants, including trefoil and lucerne, together with some species of dock, but these appeared to be never eaten. The neighbouring Unyaka and Ukinga veld was very similar, but the Unkonde veld is exposed to a much heavier rainfall, exceeding 100 inches a year.

In an animal from the highlands (Malila Plateau) the first symptoms is an erythema usually affecting the hump at its posterior and lower aspect, but also seen at times at the middle of the back. As it is only unpigmented skin that is involved, redness is very marked. The disease then spreads from the top or back of the hump down to the sides or along the shoulders, flanks, or quarters. After some time the coat may become very thin owing to the shedding of hairs, or minute drops of serous exudate appear which mat several hairs together and a crust is formed, which if pulled or rubbed away causes the hairs to shed, often leaving small raw patches. These patches again become covered with a thin dark brown scab, and in time this scab is shed leaving a dark brown scar. Sometimes the condition remains localised and a thickening of the skin is produced and the hairs, that remain are short and do not lie flat. The skin becomes very sensitive to injury. The condition may spread along to the unpigmented areas. Poor condition does not seem to aggravate the disease, and the milk yield is not reduced and death does not result even from a general infection.

In many cases the irritation was not so severe as, for example, in cattle from the Lake Shore, Ipiana. The inflammation subsides, serum no longer exudes and new hair makes its appearance, but the skin remains thickened. Cases of the disease can be seen at all times of the year. It does not appear to be at all contagious, for healthy animals may be housed for years with affected ones without developing the lesions. It could not be transmitted by rubbing serous exudate and scrapings from infected ones on to healthy animals. It did not appear to be hereditary. As a rule about 5 per cent. of the cattle were affected, in any part of the country—Lake Shore or Highlands.

The author attempts to differentiate the condition from other recorded forms of tropical dermatitis. VAN SACEGHEM described a dermatitis due to a streptothrix organism, which he named the *Dermatophilus congolensis.* In the Congo condition the disease was characterised by the formation of crusts over which the hair stood erect. This appeared to be the same with Saria. It was, moreover, characterised by its rapid spread, no predisposition as regards age and it was acute only during the wet seasons. In these respects it differs from Saria. Moreover, the Congo disease was said to attack black pigmented skin also. ARMFIELD (1918), in Northern Rhodesia, described a condition in which there were numerous wart-like processes, about ¼ in. in diameter, and when these were pulled off small hollows were left in the skin. Clean animals herded for several weeks with diseased ones were likewise said to become affected. In Saria scabs are only seen as the result of removing parts of the skin by blows or injuries and wart-like growths are not seen. In demodectic mange there are nodules in the skin, and if the contents are examined microscopically it is usually possible to find *Demodex folliculorum.* The skin lesions of rinderpest are present a long while after other symptoms of this disease have ceased, but the intense scouring leaves the animal weak and emaciated. The lesions which in severe cases take the form of ulcers around which the hair sheds may extend all over the head, neck, trunk and limbs. When scabs form the skin may become dry and parchment-like.

It is of interest to note that HORNBY has also recently described a peculiar skin disease in cattle in this region, viz., contagious impetigo of cattle in Northern Rhodesia. He, however, attributed the condition to the streptothrix first described by VAN SACEGHEM and, moreover the disease was said to be essentially seasonal in character and fresh cases were seen at the commencement of the rainy season, but after the end of the rains the disease assumed a chronic form in the survivors. [See this *Bulletin,* 1920, Vol. 8, No. 3, p. 232.]

CURSON (H. H.). **Chronic Laminitis of Cattle.**—*Vet. Jl.* 1920, Nov. Vol. 76, No. 11, pp. 418-419.

The author noted this condition while at work with the South African Rinderpest Commission on the border between the German East Africa and Northern Rhodesia and Nyasaland in May, 1918. A native brought in eight cattle to one of the Inoculation Stations (Mbosi); these animals had travelled a distance of about 40 to 50 miles. Two were old cows, three young cows, one was a yearling bull, and two were calves about four to six months old. The five oldest animals were suffering from laminitis, while the bull and two calves were quite normal. It was ascertained that the two old cows had been affected in this manner for many years, whereas the young cows (about four to five years old) had only developed symptoms within the preceding two years. It had taken 3½ days for these cattle to cover the distance, and it seemed that other cattle in the district where these had come from inevitably developed the condition when they became older. The condition would appear to be identical in appearance with the so-called "stijfziekte" of South Africa, which was proved by THEILER to be caused by eating a leguminous plant known as *Crotalaria burkeana.*

REPORTS.

GOLD COAST. **Report on Live Stock Industries of the Northern Territories.** MS. Report from the Veterinary Officer. [BEAL (W. P. B.).] Dated 27th May, 1920. 97 pp. f'cap. With 7 Appendices, comprising 4 Maps. [Report received from the Colonial Office, 28th October, 1920.]

In this report Beal submits an account of the present-day conditions of rearing live stock in the Northern Territories of the Gold Coast, and suggests measures by means of which the future of this industry might be improved and greatly increased. As compared with other great stock-raising countries situated outside the tropical zone the region under consideration cannot be said to be an ideal one. But, under certain conditions, it is more fortunately situated, for example, than Australia. In no district of the Northern Territories is there a genuine water famine; water can usually be obtained by travelling a short distance. Again, in certain parts of South Africa, *e.g.*, North-Eastern Rhodesia, Zululand, trypanosomiasis causes great havoc. In the Northern Territories reports to this effect have not been received, for although tsetse flies are to be found they are confined chiefly to the river system. Horse sickness and East Coast fever in cattle also cause ravages in the southern portion of the African Continent, but in the country under consideration these diseases have not yet been met with. The country, however, has suffered from severe epizootics, the principal one being the outbreak of contagious bovine pleuro-pneumonia in 1912–1913, and rinderpest in 1916–1917. These outbreaks, however, are not considered to have been so virulent as those experienced elsewhere. Having these points in mind the author contends that the Northern Territories are no worse off than any of the other live stock countries in the tropical zone.

Division and Administration. The area of the Northern Territories Protectorate is estimated at 36,000 sq. miles of unfenced land, with a population of 361,800 (10 to the sq. mile). It is divided into three Provinces for administrative purposes: (1) North-Eastern Province; (2) North-Western Province; (3) Southern Province.

(1) The North-Eastern Province has its Administrative Headquarters at Gambaga, and is sub-divided into four Districts: (*a*) Navarro District, controlling the Kanjarga and a portion of the Grunshi people; (*b*) Zouarragu District, ruling the Nankassi and Nankani peoples and the Fra Fra tribes; (*c*) Bawku District, ruling the Kussassi people; (*d*) Gambaga District, ruling the Mamprusi tribe. The paramount Chief, or the overlord of the tribes of this Province, is the Na of the Mamprusi.

(2) The North-Western Province has its Provincial Headquarters at Wa, and is sub-divided into three Districts: (*a*) Tumu District, ruling the Sissala, Grunshi, and the Komma people; (*b*) the Lorha District, controlling the Lobi tribe; (*c*) the Wa District, ruling the Wala and Dagarti tribes. The paramount Chief of the tribes of this Province is the King of Wa.

(3) The Southern Province has its Provincial Headquarters at Tamale, and is sub-divided into four Districts: (*a*) Tamale District, ruling the Dagomna tribe and the Daboyas; (*b*) Salaga District, ruling the Gonjas; (*c*) Yeji District, ruling the Brumasi people and the Brongs; (*d*) the Bole District, ruling the Boles.

Live stock, comprising cattle, horses, donkeys, sheep, goats, and poultry, are bred by all the tribes, in some places on a large and at others on a small scale. The only exceptions are the Brongs and Daboyas, who only breed sheep, goats, and poultry.

Physical Conditions. The land in the south is low-lying, and gradually rises by undulating plains to the centre, where these plains emerge into the plateau of the northern country, and then ends in the hilly country of the Tumu, Zouarragu and Bawku Districts. The two principal rivers are the White and Black Volta, which flow south.

The Black Volta forms the western boundary of the Northern Territories, separating it from the French possession of the Ivory Coast. At 8° 40′ north it enters the Gold Coast, and then flows east, forming the southern boundary of the Territories and separating them from Ashanti. It receives a few tributaries from this country and empties itself into the White Volta.

The White Volta is the chief river of the Protectorate and has many large tributaries, the chief of which are the Red Volta, the Kulpawn and Sissili Rivers, Nasia, Black Volta, and Dakar Rivers, all of which contain water throughout the year.

The best watered parts of the Territories lie between long. 0°–2° W., and Lat. 10°–11° N.

Average temperatures registered at Tamale were solar maximum 145, shade max. 95, shade min. 59, range 35, mean 77. Degree of humidity 55.

The average rainfall varies from 30 to 60 inches. The degree of humidity in the south is greater than that of the north and is said to run from 40 to 60.

The rainy season lasts from May to October, but July, August, and September are the chief months for rains. The dry season runs from November to April; the months of the Harmattan season, due to a wind blowing slightly west of north from the Sahara, are January and February. During this season the days are hot, and the nights cold. The climatic conditions of the Northern Territories in their bearing upon development of live stock, therefore, show a relatively high solar maximum point, but a mean of 77°, two seasons, three months of heavy rain, three months of showers, and six months of dry weather.

Origin of the Present-day Live Stock. Cattle, sheep, goats, horses, and donkeys are believed to be of recent introduction. The Central and West African tribes used to be cannibals, and it is generally considered that cannibalism is not practised when meat is obtainable, especially the meat of cattle, sheep, and goats. Moreover, no aboriginal races practice stock raising, and therefore it would be difficult to assume the existence of an indigenous breed of cattle, sheep, and goats. The only tribes which raise live stock are the Peuhlish people, and the descendants of Peuhlish marriages and the Peuhls themselves are immigrants from foreign parts, having been descended from an intermixing of Arabs with Negroid races. These people and their descendants in their advance westwards, certainly introduced the zebu ox, the present-day breeds of sheep and goats, the horse and donkey. But the Taurine type of cattle found in the Territories is believed to be of a different origin (see later).

Present-day Methods in Vogue for Rearing Live Stock. As practised by the natives these are crude and unsatisfactory to the last degree, everything being left to chance. There is no division of the herds or flocks, no provision is made for the foraging of stock during the dry season, and the animals have to depend entirely on the grazing obtainable. The only care taken is to supply them with water, often very inferior. Dietetics, selection, and other hygienic principles are unknown. The value of the stocks at the present day lie solely in their intrinsic value. It is hoped by a system of gradual education, frequent visits to live stock owners, and giving popular lectures, to eliminate most of the faults perceived.

Grazing and Feeding. The grazing lands are unfenced and are the common property of the peoples irrespective of whether they are the indigenous races or immigrants importing and driving cattle to Ashanti and the Gold Coast Colony. During the rainy season and up to the end of November there is no scarcity of grazing and at this time it is good and abundant. After this time the ground becomes dried, all the grasses become dry and brittle except in pastures in the vicinity of rivers and swamps. The country now begins to be "fired" and gradually becomes a black waste. If the pasture lands were "fired" at what is regarded by Beal as the proper time so as to catch the three or four showers that occur in October and sometimes in November new shoots would grow and this grazing would probably last into the months of December and January, that is, the Harmattan season. After the Harmattan has passed new blades of grass are frequently seen shooting up. On account of this annual "firing" most of the perennial grasses grow deep roots and the annual grasses get destroyed and re-germinated in part from seeds that have been blown about and escape the fire. The natives seem to possess a little knowledge as to the character of the various grasses. The annual firing causes the grasses to be formed almost entirely into ash, containing potash and sodium salts. These serve to invigorate the soil, but potash in excess is deletereous to animal growth. In the low-lying countries there is a deficiency of carbonates and phosphates. The deficiency in phosphates may account for the small size of the cattle. In the low-lying areas there are no stones whatever, and in the low-lying areas of the north, where the ground is stony, the cattle are larger than those to be found where there are no stones. The difference is not considered to be attributable to the damp atmosphere alone. As one proceeds further north the ground becomes stony with quartzite, granite and laterite outcrops, and still further north it becomes hilly. The action of the rains on these stones washes into the soil carbonates and phosphates of calcium and iron in particular. The cattle of this northern zone are distinctly larger than those of the southern zone, and their size is believed to be due to the greater quantity of carbonates and phosphates in their fodder.

The grasses hitherto identified comprise the following:—*Cenchrus catharticus,* Del.; *Digitaria horizontalis,* Willd.; *Eleusine indica,* Gaerth.; *Eragrostis ciliaris,* Link. (all good fodder); *Pennisetum purpurem,* Schum. (the tall elephant grass), indifferent fodder. These were identified by Chipp (T. F.), late Assistant Conservator of Forests, Gold Coast. The following grasses collected by Beal were identified at Kew:—*Cymbopogon rufus, Eragrostis aspera, Eragrostis tremule* or *Iryza silvestris,* all found all over the Northern Territories, together with *Arachishypogea,* the wild species and origin of the present-day cultivated ground nut. The seeds of 19 other species were collected and remain to be identified.

Cattle. The breed of cattle in the Territories is the humpless (taurine) type of cattle. A few of the humped (zebu) breed occur, and are usually confined to the divisions bordering on the northern frontier of the Protectorate. Crosses between these two breeds are fairly numerous, especially towards the northern frontier. The origin of the taurine type, which is identical with that found indigenous to Dahomey and French Guinea is a debatable subject. Many writers state that it is of Asiatic origin, having been introduced by the Peuhls in their advance westwards. Pécaud, who has made a long study of the cattle in Dahomey, considers that the type is indigenous to Central and West Africa. On the other hand Cardemoy and Wellaert disagree for reasons mentioned before. Cossar Ewart has examined the skulls of this breed and believes that it is of Celtic shorthorn origin. Beal agrees that there is a great simliarity between this breed and the British shorthorn when they are both carefully examined in nature, although the West African breed, of course, is degenerate, due to inter-breeding and climatic conditions. There is no record of the early British pioneers having brought out with them any British cattle. Different names are often given to the cattle of different localities in the Territories, thus conveying the impression that there are in existence many different breeds. Beal, however, insists that there is only one breed, and that is the humpless taurine type, and that the Dogomba, Lobi, Dagarti, and other so-called breeds are in reality but one breed slightly distinguishable due to different methods of breeding and climatic conditions. These cattle are small, symmetrical compact animals, very much like a miniature shorthorn. They are slow to mature and reach their full size at the age of 6–8 years. Bulls and bullocks, when allowed to reach their full development, turn out to be very fine animals and for their size would be able to compete against some of the European small fancy breeds, such as the Dexter Kerry cattle. Heifers become sexually mature at from 18 months to 2 years old, bull calves at 15 months. Calves as soon as they can graze, *i.e.*, when they are about three months old, are muzzled with spikes in certain districts to prevent them from sucking and the mother thus dries off and comes into season again, so as to produce calves yearly. Otherwise calves are not born yearly, and if the cow is left to herself she will give milk from 6 to 9 months. The cow comes into season from 6 to 12 months after calving. A good milking cow gives on an average about 2 pints of milk a day. A table indicating the various body measurements of these animals in the different districts is given. The averages were as follows:—Average age 7 years, length of body to shoulder 46 in., to muzzle 65½ in., girth behind shoulder 54½ in., in front of back 55¾ in., length of forearm 11 in., length of thigh 14¾ in., bone below knee 6¾ in., below hock 7 in., head length 16¼ in., breadth 7¼ in., width across loins 13¾ in.

The chief colours of the breed are black, and black and white. Brindles are common and when seen are grey. Red and white and yellow and white also occur. The shape of the horn varies from right-angle projections to those that curve downwards, forwards, and backwards into lyre shape. The feet are usually black, but should white be very predominant the feet are white, or white and black.

The breed is a hardy disease-resisting animal and a very good feeder and forager. The meat, although of good quality and taste, lacks marbling. In the hilly regions and on stony ground it runs into a bigger animal, and in the north along the frontier it is probably mixed with zebu blood but has lost the characters of that breed. The chief faults in connection with the breeding of these cattle are: inter-breeding, commencement of breeding at too early an age, starvation of calves, improper feeding of cow during lactation, no regulation of calving time, abundance of ticks on cows and the infection of cattle while they are young with disease, especially blood diseases. Measures are suggested for remedying these faults.

As a market animal for the butcher the type is small and compact, but fails in not having a larger girth measure in the pubic region as compared with the girth behind the shoulder. It again fails in its hind quarters. The price asked for one of these small cattle is equal to that demanded for a four-year-old humped beast, and in consequence the butchers are not ready to purchase the smaller cattle, unless there is a shortage of humped oxen on the market. The small humpless cattle, however, furnish meat of a better quality. For the purposes of the butcher, however, the larger animal is more greatly in demand. Beal recommends crossing the native animal by using as a sire the humped zebu bull. One hundred of these bulls could be purchased for the sum of £1,000 yearly for five years, branded and issued to the different breeding districts, and changed every two years. Care should be taken to see that these bulls were not diseased. Beal also recommends as an experiment the introduction of say three English bulls of the Hereford breed, not too highly bred or pampered, and 6, 9, and 12 months old respectively. These should be immunised beforehand by the Board of Agriculture against piroplasmosis and anaplasmosis, and two of them should then be exported to Coomassie. If all three survived the effects of the inoculation the 6-months-old bull should be kept back and exported at a later date. The bulls should be used to serve the ten cows and five heifers kept in the Government Herd at Coomassie. These could then be taken up by motor to Tamale and issued to Dagomba breeders to calve down, the breeders returning to the Government 18-months-old heifers in exchange. With the establishment of a branch of the Veterinary Department at Tamale, and the joining up of Tamale with Coomassie by railway many more bulls could be introduced into the Territory. The experiment with the three bulls would cost the Government about £250, exclusive of motor transport.

Sheep. The sheep of the Territories are small animals which produce hair instead of wool. They were probably introduced by the Peuhls into West Africa. There are two breeds of sheep in Africa which produce hair: one is a fat-tailed sheep descended from the Karakul breed of sheep of Asia, and the other a Moroccan breed of sheep called the Barbarin. The breed found in the Northern Territories is probably descended from the Karakul, but has lost its characteristics through climatic conditions and also by prolonged inter-breeding. The newly-born lamb exhibits the peculiar curl of its hair which is characteristic of the Karakul breed. This curl is soon lost after birth; it is scarcely seen at two weeks, and at a month the hair is entirely straightened out. This is the only breed found in the Territories—a small wire-haired sheep which can be easily picked up and carried. In colour it is pure white, or white and black, or an admixture of white and black. No mixtures of red and white or yellow and white are seen, as occurs in the Fulan or Lagos breed of sheep. The males are furnished with good regular-curved horns, have a crest of hair on their neck, and a long beard of hair running from the jaws to the breast. The ewes sometimes possess a straight stump of horn, have a good and well-shaped udder, and are good mothers. Beal gives measurements of both males and females. Castration is resorted to more often with rams than with bulls, but the faults of breeding are similar to those attached to the cattle breeding. The sheep are readily accepted by butchers in the markets as they have no other supply.

Sheep-breeding is a profitable industry for the Territories to engage upon, as these animals can be bred in every village. Their chief enemies are the hyenas and leopards, which take a considerable toll yearly. The fault of the breed lies in its small size and lack of taste. It thus becomes necessary to introduce foreign blood, as there is no breed available in West Africa for improving the native breed. Two breeds of sheep have done well in Africa, viz., (1) Merino, and (2) the Karakul breeds. The Merino breed is a fairly large sheep which furnishes meat of very good taste and a good fleece of wool. Its fleece would be a drawback in a hot climate, but nevertheless the French Government have done well with this breed in the bend of the Niger north of the Northern Territories. If it is introduced it can only be kept in the open country, and not in the forest country, where the climate is hot and damp. The Karakul sheep is a fair-sized animal with a broad fat rump and tail. It is a haired breed and when the lambs are killed young they furnish a valuable pelt. Both breeds are not pampered sheep, are accustomed to hardships such as scanty fodder and water, and ought to do well in the country.

It is not thought likely that any English breed would be so suitable as they are pampered, and usually live under the best conditions. However, the author suggests that in 1921 a start might be made by introducing two Merino rams and one Dorset ram. These could be used for serving ewes at Coomassie and these ewes could be sent up to the Dagomba country by motor to lamb, and others brought down for further service and sent back.

Goats. The goat is also an imported animal, probably of Asiatic origin. It is a very small mis-shapen animal, due to many generations of inter-breeding. The general colour is brown. The males are very small for before they have reached their final stage of development they are killed off for food; they possess the usual caprine style of horns. The females are frequently of bad shape but they possess good udders and give plenty of milk to their young; they are not milked by the natives, all the milk furnished being consumed by their young. The breed should receive considerable attention, as it is fast degenerating. The breed recommended for their improvement is the Angora breed of goat. Six males should be introduced in 1921, at a cost of £100.

Horse. Also of recent origin and probably introduced by the Peuhls. This view is supported by the native mythology. From the shape of the head and ears the horse is probably of Arab origin. The colours are chiefly bays, and then come blacks, chestnuts and roans. As a rule they are wanting in bone and good hind quarters. They run up to 14 hands high, but 13.2½ hands is the average size. The larger height is usually seen in imported horses. Very few stallions are castrated, the mares are degenerating and no selection for service by good stallions is practised.

Horses are better cared for than the other domestic stock. They are given an extra diet of ground nut hay, and bean and pea hay during the dry season when grass is scarce. If they are used for riding they are given guinea corn when this is plentiful, or millet. They are housed at night time, but during the day they are hobbled and led out to graze. When grass is scarce they are tied up all day outside the compound or under a tree, and fed on grass cut up as chop. The forelocks, manes, and tails are covered with charms to ward off disease. Measurements are given of stallions in different districts, varying in age from 7–14 years, in height from 13 to 13·3 hands, in bone from 6¾ to 8 in., and in girth from 62½ to 68 in. The horse bred is therefore small in spite of the fact that there is no inter-breeding. This is attributed to two reasons—(1) absence of selection of sire, and (2) deficient dietetics. A mare in season is served by the first horse she comes across, irrespective of its quality. During the gestation period, and after giving birth to the foal, she is not properly fed and the young animal, when it is a year old and upwards to the time that it is broken into the saddle, gets no corn. Both mare and foal have therefore to rely for their nourishment on grazing in a country lacking in calcium carbonate and phosphates.

These faults could be remedied by teaching breeders selection of sires and frequent lectures on dietetics. Afterwards they could be educated on the improvement of the breed. At present horses are not required for draught work in the country as the native relies upon a hoe for tilling and ploughing the soil. If the breed is to be improved, so as to render it more suitable for purposes of saddle work only, there ought to be no difficulty in finding suitable English thoroughbred stallions of about 14·1 to 14·3 hands high for this purpose. It would be no use bringing out large stallions to serve these small ponies. However, if they are to be improved for draught purposes one of the small heavy breeds of horses ought to be introduced, and for this purpose the French Percheron is recommended. The author also strongly advises the introduction of a small plough to replace the primitive hoe, so as to bring about better and more widespread cultivation of the soil, especially so as to obtain legumes for feeding live stock. At present the natives are chiefly concerned with producing just sufficient crop for themselves and their families. The author recommends that the improvement of horse-breeding should be delayed at present until a Branch of the Veterinary Department has been established in the Northern Territories.

Donkey. Also of recent introduction. Donkey-breeding is on the increase. The animal is a fair-sized one as compared with other live stock. It is hardy and a willing worker, light in colour, with the characteristic spinal stripe and frequently with shoulder and leg stripes. Average height 12 to 12·2 hands. The female possesses a good udder, is not milked by the native, and gives a good deal of milk to her young.

Donkeys are housed in the compound at night time. During the day their fore-legs are hobbled and they are led out to graze. The grazing is augmented in the dry season by the addition of ground nut and pea nut hay. They receive very little guinea-corn. No selection of good jacks is made for service, but very little inter-breeding goes on as donkey breeders are continually purchasing new animals or exchanging donkeys for cattle and sheep. Donkeys are used as pack and riding animals.

The future holds forth good prospects for donkeys as pack animals in the transport services of the Territories. On some of the roads 100 lbs. can be easily carried, and a good animal should carry 150 lbs. Their cost and upkeep is very little. The breed requires very little improvement. The only direction in which this is much required is in dietetics during the growing period of the donkey.

Pig. Very few pigs are bred in the Territories. The chief pig-breeding part is in the Kacomba country, Yendi District. The animal is probably descended from the wild wart hog, frequently seen in all the swampy areas. The animals are small and black, the boars are frequently killed off for food before they reach their full development, the females live longer and in consequence appear larger than the boars. The sows farrow easily and have large litters, often 11 or 12 in the litter.

The pigs are housed in a small house outside the compound. The principal food is found by scavenging around and about the villages, and in foraging and rooting in the farms. The Kacomba people take special care of their pig, as they consider it a tasty article of diet; they are watered and fed on cassava when the country has dried up and roots are scarce.

Pig breeding ought to be encouraged among the pagan peoples. The chief obstacle is the scavenging and rooting methods of the pigs on the farms. It is useless to confine them in styes, as they do not do well in confinement. They require a run of the grazing areas, so that they can root and find their food. Breeding should be encouraged so as to augment the available source of food material for the native, and thus relieve the already great demand made on cattle, sheep and goats. In large villages pigs would probably be a nuisance, but in the smaller ones they could be made the basis of a profitable industry.

In the Gold Coast Colony, along the coast line and behind the lagoons, countless number of pigs are bred and require improving. In Ashanti where the pig industry is gradually being exterminated at the whim of the white man, it requires encouraging and improving.

The introduction of English boars and sows for the improvement of the indigenous pig should be kept back until the personnel and functions of the Veterinary Department are increased. It is useless to introduce pigs and hand them over to the native to bring about improvement of the breed.

Poultry.—(1) Fowls. The native fowl kept by every household is a small hardy bird of almost every colour, with game features predominant. Fowls of this sort are kept and reared by the natives for their own use and for the market. They can readily be improved and respond well to the introduction of European blood. The best cross is with game and Orpington birds.

Ducks. Do well and thrive in districts where bred. No improvement required.

Turkeys. Where these birds are kept and bred they do well, but few are bred in the Northern Territories. The industry requires developing in order to ensure the future food supply of Ashanti. It is recommended that 100 turkeys should be purchased in the Addah and Quittah Districts, and sold to the natives in the Northern Territories to commence breeding operations.

Pigeons. Wherever there is a Mahommedan settlement these are bred. No improvement required.

Guinea Fowls. These are bred by every household. Immense numbers are bred by the Kanjargas and Fra Fras, as their women are not allowed to eat the ordinary fowl.

Ostrich. Not bred in the country. Those seen are imported from Upper Senegal and Niger, and are kept to supply the itinerant trade in ostrich feathers. When meat is scarce they are frequently killed for food and eaten by the people.

Guinea-pig. In certain large towns where there is a Mahommedan settlement this animal is bred for food.

Increase and decrease of live stock. Dealing with the yearly losses among stock, the author makes these out to be at present very serious, and the losses amount to at least 35 per cent., made up as follows :—Diseases 22 per cent., sales 5 per cent., transfer out of Northern Territories 2 per cent., killed to satisfy the native customs 3 per cent., wild animal attacks 2 per cent. (probably much higher for poultry), and presents 1 per cent.

It is suggested that these losses can be prevented (1) by placing their control entirely in the hands of a Veterinary Department with a sufficient staff to cope with animal diseases; (2) the sale of bulls and bullocks should not be hindered, but they should not be sold under a certain age—two years old—before they have completed their growth. Barren cows and old cows that have gone barren should be sold only under permission of a competent authority. Sales of heifers and cows for the butcher should be prohibited. A high export duty should be placed on the transfer and bartering of cows out of the Territories; (3) a regulation should be framed prohibiting the slaughter of females, whether of cattle, sheep or goats; (4) a freer issue of shot-guns and more powder should be allowed to enable people to keep down wild animals. The natural enemies of poultry—kites, hawks and eagles take a heavy toll—about 30 per cent. of the chicks. Nothing can be done to eliminate their attacks. But when the country is opened up wire netting ought to be obtainable so that the chicks could be placed in runs.

The author next discusses the conditions as they affect animal-breeding in each of the districts named above, and deals in particular with the diseases encountered.

Entomological Situation and its Relation to the Live Stock Industry. A number of observations on this question were made during tours of inspection.

The tsetse fly question in its relation to live stock breeding appears to be somewhat complicated. SIMPSON (J.) has already studied the factors influencing the distribution and prevalence of this fly in the Territories (see this *Bulletin* 1918, Vol. 6, p. 78).

This observer maintained that if the country were thoroughly searched tsetse could be found everywhere and that so-called fly belts did not exist in reality; in other words, if the country were thoroughly searched the fly would be found linking up these belts. He further asserted that certain precautions taken in the Territories with regard to excluding horses from them only led to a false sense of security. Beal, on the contrary, does not adhere to this view, and claims that there are " pockets " in the Territories free from tsetse running from 1 sq. mile to 10 sq. miles in extent. On certain days it is admitted that tsetse scatter for their food and may be found in an area where they were never seen before and which is totally unsuited for them ; their natural instinct, however, is to remain close to their birth place, and the areas free from fly are indicated on a map. The chief species found were the following :—

Glossina morsitans, fairly common, an inland fly not seen in pure savannah districts but seen in the so-called savannah forest districts, especially in close and muggy places (*e.g.*, Makongo, Yamalaga, Daboya, Zantana).

G. tachinoides, very common, confined to the river system. During the rains they may be found alongside rivers with grass banks, but they are chiefly confined to river banks covered with shrubs and small scrub (*e.g.*, Rivers Sissili and Kulpawn).

G. palpalis, fairly rare, chiefly found on river banks covered with a dense undergrowth and overgrowth [*e.g.*, Rivers Volta (White and Black)].

Among the indigenous live stock outbreaks of trypanosomiasis with resulting heavy mortality do not occur. Such outbreaks have occurred among horses, but these have usually been imported animals. The live stock in the fly areas do not appear to suffer any appreciable harm by living there; although these animals are small they are as a rule plump. It would therefore appear that the native live stock has acquired a high degree of resistance to the prevailing strains of trypanosome. Among the native breeders the fly is not blamed for the production of any disease.

Stomoxys. The common stable fly is met with wherever there is live stock. The species most commonly found is *S. calcitrans,* which is confined to the villages and, as a rule, does not follow live stock out to grass. The author in 1912 in investigating an outbreak of trypanosomiasis among horses at Accra attributed the spread of the disease to Stomoxys and Lyperosia flies found in the district. Given a reservoir of infection Stomoxys appears to be capable of maintaining an enzootic centre in an area. These flies also act as carriers of two worms—*Habronema microstoma* and *H. macrostoma*—found in the stomach of the horse and donkey.

Hippoboscidae. The common species found is *Hippobosca maculata,* or cattle fly, a yellowish red fly, with a very hard skin, and exceedingly difficult to kill. Capable of transmitting trypanosomiasis mechanically, like Stomoxys.

Tabanidae. Known as the swamp or mango fly. Many species are found and cause annoyance to cattle, which fear attack from this fly very much. Also incriminated with maintaining an enzootic centre of trypanosomiasis by mechanical transmission.

Molluscs, Gasteropods (snails and slugs). Worm parasites which require to pass certain stages of their life history in snails, such as, for example, the common liver fluke of cattle, sheep, and goats, are found. The horse fluke, *Gastrodiscus aegyptiacus,* is also mentioned.

Ticks. The only method at present adopted for ridding the country of ticks is to burn the pastures at a certain time of the year, but this process is unsatisfactory. The ticks are subject to attacks of natural enemies, such as the white cow bird or tick bird and the domestic fowl. The native cattle owners have always been accustomed to seeing ticks on their stock and do not attach much importance to them. They seem to be quite unaware of the continual drain of blood from the system (estimated at up to 500 lbs. of blood in the course of a year). Ticks cause marked stunting of growth which renders the animal unfit for the butcher two years longer than it would have otherwise been. The decrease in the milk yield of milch cows due to these parasites may amount to over 40 per cent. Tick bites also cause marked depreciation in the value of the hide. The ticks found in the Territories have also been studied by SIMPSON (*loc. cit.*). They are the following:—

Amblyomma splendidum, fairly rare, found on cattle; as far as is known it does not transmit disease.

A. variegatum, common, found on cattle and sheep to which, however, it does not appear to transmit any specific disease.

Boophilus australis, common, found on cattle, transmits redwater.

B. decoloratus, very common, found on cattle, sheep and goats, conveys redwater and also, it is said, spirochaetosis in cattle.

Haemaphysalis aciculifer (not encountered by Beal).

H. leachi, found on carnivora, especially the dog, rarely on cattle, sheep, goats and horses. Transmits canine piroplasmosis.

Hyalomma aegypticum, common, found on all domesticated animals, transmits bovine redwater.

Rhipicephalus sanguineus, common, found on dogs, sheep and goats, transmits canine piroplasmosis.

R. simus, common, found on cattle, transmits East Coast Fever.

The more important Epizootic Diseases of Live Stock. These include anthrax, contagious bovine pleuro-pneumonia, contagious foot rot, epizootic lymphangitis, filariasis, fowl cholera, piroplasmosis, rinderpest, haemorrhagic septicaemia, and trypanosomiasis.

Anthrax.—This disease prevails especially during the dry season, when the swamps have dried up and the underlying ground becomes available for grazing. It is particularly when the grasses are eaten right down close to the ground that the animals become attacked. It seems that hundreds of cattle, sheep and goats become yearly affected with this disease and recover, and it is probable that some are infected many times during their life. Three forms of the disease are described, viz.: (1) the epileptic form, in which the animal may succumb at any time from within 6 to 24 hours after first showing symptoms; (2) an internal form, in which after showing symptoms of fever and colic the animal may pass blood-tinged faeces on the second and third day and sometimes streaks of blood from the nostrils; these animals are usually destroyed; (3) a local form in which the lesions are confined to the skin or to the throat, swellings being formed which are frequently attributed to snake-bite. Death when it does occur takes place on the third or fourth day. In addition, many animals contract a mild form of the disease and show no outward appearance of being affected.

Sporadic cases are frequently noted all over the Protectorate and the mortality rate is estimated at 4 per cent. per annum for cattle and probably higher for sheep and goats. The disease is fairly rare among horses and donkeys as their feeding is better looked after.

Contagious bovine pleuro-pneumonia.—The zebu breed of cattle is stated to be most susceptible, on account of the large circulatory and lymphatic system in these animals. The breed of cattle found in the country is not so susceptible. The cattle that are noticed to become affected are the more docile ones, which tend to remain in close proximity to the infected animals. In the Northern Territories the disease is spread and kept alive on account of the fact that all grazing rights and water are common property and cattle are transferred as marriage settlements. A clean herd may travel for water or grazing from 2 to 10 miles and is then brought home and perhaps next sent in another direction for pasture or water. In this way the disease may be carried considerable distances. An active unrestricted commerce in cattle is also a prolific means of spread. During the years 1912–1914, when the disease broke out in the Territories, the Government was duly warned to take action to control the importation and movement of cattle through the country, but no action was taken, with the result that the disease is now enzootic and takes a yearly toll of about 13 per cent. of cattle.

In order to ascertain the presence of the disease in a suspected herd the best method is to visit the kraal early in the morning before the animals are disturbed and listen for animals that cough. After making the animals travel a little distance (about 400 yards) others can again be picked out. These animals should be segregated.

Contagious foot rot.—Cattle, sheep, and goats are frequently affected with this disease during the rainy season, when the cattle compounds may become so sodden that the animals stand up to their knees and hocks in mud. The affected feet emit a foetid odour and a black stinking discharge can be squeezed out of the heels and soles. The condition is probably due to the necrosis bacillus. Usually two or three animals in a herd or flock are affected with this condition.

Epizootic lymphangitis.—This disease is known to the natives as "yaws." It is not very common, but many cases can be seen among horses on making careful investigation. It is said to be spread by the agency of flies, heel ropes, and saddlery equipment. The natives do not consider the condition contagious and hence the affected animals are not segregated. In the treatment of the disease they use charcoal, black antimony and copper sulphate. As a rule, these cases recover after a long period of treatment.

Filariasis.—Live stock are said to suffer from a filarial infection, transmitted by some species of Culex. The mature worm is frequently found in the peritoneal cavity of the horse, ox, sheep and goat. The embryos are often seen in blood smears taken from cattle and horses. The extent of the damage done to cattle by the infestation was not ascertained, but in horses it appears to be the cause of an intermittent fever associated with other symptoms. [For observations on this condition in the adjoining French territories see this *Bulletin*, 1920, Vol. 8, No 2, p. 126.]

Fowl cholera.—This appears to be a serious disease of poultry, characterised by symptoms of profuse diarrhoea and dejection with death in from 1 to 3 days.

Piroplasmosis.—The most frequently found piroplasms of cattle in the Northern Territories are *Piroplasma bigeminum, Theileria mutans,* and a third piroplasm which is occasionally met with and was described by the author in his Annual Report for 1911. The last-mentioned parasite has also been recognised by MACFIE (J.), who identified it provisionally as a species belonging to the genus *Achromaticus*. These parasites set up merely benign affections, inasmuch as all calves become infected shortly after birth.

T. parva, the cause of East Coast fever of cattle, has not, according to the author, been discovered in the country in spite of frequent search. A tick which is capable of producing its spread, viz., *Rhipicephalus simus*, exists and would represent a serious factor if the disease should ever be introduced. There is, in fact, communication between the country and Central and East Africa, via the Lake Chad district, and therefore West Africa lies open to its introduction at any time.

The horse is also said to be subject to infection with *Nuttallia equi*, which produces a dangerous anaemia frequently terminating in death. Up to the present time piroplasmosis has not been detected in sheep.

Rinderpest.—An epizootic of this disease affected the country in the year 1916, and raged up to the early part of 1918, causing a mortality of 50 per cent. of the cattle. It is said to have been introduced to West Africa from Central Africa via Lake Chad and the French territories by means of cattle caravans. The disease is not enzootic in the country and the conditions are said to be such that it is not likely to become enzootic, on account of the fact that the country is nearly all savannah country exposed to direct heat and sunlight, and the temperature is too high for the maintenance of the virus for a long time outside the body (solar max. 145° F., shade max. 95°, shade min. 59°, with a range of 35°). It was noticed that calves born of cows that had passed through an attack of the disease during their last months of gestation were usually immune.

Haemorrhagic septicaemia.—This disease, caused by organisms of the fowl cholera group, affects cattle, sheep and goats. In cattle it is fairly rare, and so far has only been met with in Coomassie; three forms were recognised, viz., a pulmonary form, an intestinal form, and a local form. It is difficult to distinguish these diseases from anthrax except by means of the microscope. Death occurs in from 12 hours to 4 days.

In the sheep and goat the disease is fairly common. The pulmonary and intestinal forms are most frequently met with and usually occur simultaneously in an affected animal.

Trypanosomiasis.—Three species, or rather types, of trypanosomes are known to occur in the Northern Territories, viz., *T. brucei* (*pecaudi*), *vivax* (*cazalboui*), and *congolense*. The disease is transmitted by the bites of the tsetse fly, and other biting flies are capable of maintaining a local focus of the infection by mechanically transmitting the infection.

The symptoms caused by all three species are very nearly the same in horses, but infection caused by *T. vivax*, however, is not so severe as that caused by *T. brucei*. Most of the recoveries that do take place occur after *T. vivax* infection. Symptoms are first noticed in the horses in from 17 to 45 days after infection, when the animal suddenly develops a number of urticarial swellings each about the size of a shilling and called plaques. These swellings disappear in about three or four days, when the animal becomes affected with a puffy swelling in the fetlock region. The scrotum and submaxillary glands then become enlarged and swollen. There is lachrymation from both eyes and the conjunctival mucous membrane becomes yellowish and covered with a number of petechiae. A swelling develops under the abdomen and runs forward or backwards, the muscles of the loins and quarters appear to have become wasted and shrunk. These symptoms develop during the first month and during this time the temperature is very irregular, on some days 105° and on others 103°.

During the second month wasting of the muscles and weakness of the hind quarters are particularly marked, the horse sways on moving, drags its hind legs, and does not flex its joints. The appetite diminishes, the joints become enlarged, the scrotum and sheath are markedly swollen and the temperature varies from 102° to 103°.

During the third month emaciation in particular is very marked and all the other symptoms are more pronounced, the horse becomes very weak, and affected with paraphimosis, the mucous membranes are blanched and the anus relaxed. Finally, the horse lies down exhausted and dies in two or three days.

Atoxyl is considered to be undoubtedly the best drug to use for treatment, combined with good nursing and feeding, in cases that are not too far advanced.

In cattle *T. vivax* does not appear to cause much harm and no symptoms were observed. *T. brucei* is said to cause a sudden emaciation, which becomes chronic and lasts for a year, after which the cattle gain some degree of tolerance towards the infection and commence to put on flesh again. In imported horned cattle that have to travel long distances by road emaciation and weakness of the hind quarters are noticed and on account of the hardships these animals have to endure they usually fall exhausted at the end of the journey and die within two days. *T. congolense* was first discovered by the author in the country in 1912 and hitherto has only been found naturally in horses, in which all the chief symptoms of trypanosomiasis were seen. It is said to be not so virulent as *T. brucei*, but more virulent than *T. vivax*. By experimental inoculation it was very fatal to the sheep, goat and dog.

Cattle Trade.—This trade appears to be small and many more cattle could be exported if the herds were increased. It is estimated roughly that the trade in indigenous cattle for the year 1919 could be represented at 2,000 head.

Position of the Meat Supply. At the present day this supply comes from the French Territories. Early in 1914 the French authorities opened two large abattoirs with refrigerators at Lydianne and Bamako for the exportation of chilled beef to France from the Port of Dakar. Lydianne dealt with about 300 carcases a day during the war. In 1915–1917 rinderpest ravaged their herds and killed off from 40 to 70 per cent. of the cattle and the export of cattle from French West Africa was prohibited in order to conserve the supply of meat. However, the Ordinance was subsequently modified so that certain spheres of the French country were allotted for the supply of the British Colonies of Nigeria and Gold Coast. These spheres are indicated in a map which accompanies the Report. In the event of further developments taking place in the chilled meat exporting industry of the French territories the meat supply of the Northern Territories may, however, at some future date become seriously endangered, for the country itself is not in a position as yet to supply the 40,000 head of cattle required yearly for the butcher. Even at the present time the trade from the French territories is gradually decreasing.

Cattle Routes.—The present method of importation of cattle (from the French territories to the Gold Coast) through the Territories is undesirable, for the country is open and unfenced and the breeding districts lie at the mercy of the cattle trader, who may introduce and disseminate disease with his animals. Prior to importation, therefore, the cattle ought to be submitted for examination, or else certain routes ought to be laid down along which the cattle droves are compelled to pass to the markets, under pain of heavy penalties if they are found off the routes. The principal ports of entry are at Bawku and Paga. Water and grazing would have to be provided along these routes. A series of routes are suggested and traced out.

Estimated Live Stock Census and Valuation in the Northern Territories and Yendi District. Cattle 68,500 head, valued at £548,000 (40,967 head of these cattle were inspected and valued at £327,736). The average price of cattle was taken at £8.

Sheep and goats, 150,000 head, valued at £75,000 (50,931 head were checked and valued at £25,466). Sheep and goats were valued each at 10s.

Horses, 1,097, valued at £10,970.

Donkeys, 2,003, valued at £10,015. The horse was valued at £10 and the donkey at £5.

Pigs, 321, valued at £963. The pig was valued at £3.

The total estimated value of live stock, therefore, amounts to £646,985, and somewhat over half of these animals were inspected. The estimated expenditure of the Veterinary Department for the year 1920 was £3,799. It is therefore computed that the Government spend 1¼d. in the £1 to safeguard the industry, a sum which is not regarded as very generous.

Beal makes a number of important recommendations with regard to the re-organisation of the Veterinary Department, and the division of the Department into three sections, viz., a veterinary section, live stock section, and legislation section.

NYASALAND PROTECTORATE. **Veterinary Report for the Year ending 31st March, 1920.** [GRIFFITHS (J. A.), Chief Veterinary Officer]. Annual Report of the Department of Agriculture, Nyasaland. pp. 8–10, f'cap. Zomba: Govt. Ptr.

Rinderpest. The Rinderpest Commission which carried out the operations for the formation of the "Immune Belt" in Tanganyika

Territory, Lakes Nyasa and Tanganyika, terminated their work in April, 1919.

At present the situation with regard to this disease is quite satisfactory for there exists a belt of country in which all the cattle were immunised during 1917 and 1918, and to the south of this there is a belt between the lakes which is cleared of cattle. In Nyasaland, to the south of the cattle-free belt, there is a control area in which the cattle are registered, births and deaths recorded, and movements of cattle only allowed under permit. There does not appear to be any rinderpest in the districts immediately to the north of the immune belt.

No outbreak of East Coast fever has occurred outside the areas in which this disease is enzootic.

In areas settled by Europeans there has been very little trouble from tick-borne diseases, except when dipping has been neglected. More dipping tanks are being built every year so that it will soon be possible for most cattle owners to have a dipping tank available within easy distance.

There have been a few cases of demodectic mange in cattle in the Blantyre district and all these cattle were slaughtered.

Outbreaks of trypanosomiasis have occurred in cattle in various parts of the Shire Highlands, especially on the Namiwawa stream, south of Zomba. In two outbreaks there was a history that the animals had previously been brought through tsetse belts, but in the other outbreaks the sick animals did not appear to have been near the belts. On the Government Farm at Namiwawa the disease has occurred sporadically among the working oxen for several seasons, in spite of the elimination by slaughter of animals found by microscopic examination of the blood to be infected. No tsetse fly occur on or near the farm. Thus the disease must have been transmitted by flies other than tsetse. Drug treatment seems to be of value in all cases where the disease is not far advanced. As the result of treatment the animal's life is prolonged and its condition improved to such an extent that it can be fattened for slaughter, while in about 60 per cent. of the favourable cases the animals are able to resume work.

A fairly large number of cattle succumb with gastro-enteritis as a prominent symptom. The chief causes are: (1) arsenical poisoning; (2) coccidiosis; (3) poisonous plants; and (4) parasites. Intestinal round worms in calves are the cause of heavy losses among young stock throughout the Shire Highlands. The liver fluke also accounts for losses among cattle when the animals have had to undergo a long journey or have had their vitality reduced by some other cause.

In sheep the chief diseases are: (1) Distomiasis, due to *Fasciola gigantica*, the cause of losses among European-owned sheep in the Zomba district; (2) tape worms, said to infect the bile ducts as well as the intestines and said to be the cause of poverty in condition throughout the Highlands; (3) contagious pneumonia—one outbreak in which there was a high mortality is reported; and (4) grass poisoning, which caused heavy losses in a certain marshy district owing to the animals feeding on fermenting vegetation after the floods had subsided.

Pseudo-rabies. This disease, which affects dogs and cats in Nyasaland, clinically closely resembles true rabies. It is apparently transmitted by the bite of an infected dog. In six cases observed there was a history that the animals had been bitten by an apparently rabid stray dog about a fortnight before symptoms were seen. The symptoms are first uneasiness, difficulty in swallowing, dribbling of saliva, followed by a general hyperaesthetic condition with twitching of the muscles and loss of co-ordination of the limbs. As the condition progresses the animal emits at intervals a peculiar wailing cry and just before death snaps at imaginary objects. On post-mortem the stomach is found to contain various foreign bodies, as in true rabies. Human beings have not been reported to have contracted the disease. In only one case has a positive reaction been obtained by the biological test for rabies with material from an apparently rabid dog (GARDEN, 1916).

Importations. During the year 18 bulls and 164 cows were imported for breeding purposes and 252 head of slaughter stock and trek oxen, together with 23 pigs, 10 dogs, and 1 donkey. Cattle of the Aberdeen-Angus, Sussex, and Ayrshire breeds have been imported and distributed in various parts of the southern districts for stud purposes. Pigs of the Berkshire breed were imported for breeding purposes.

The Veterinary Staff appears to be inadequate for the work demanded of it and there is urgent need for a research laboratory. Stock of all kinds have increased from 100 to 200 per cent. in market value. A number of diseases require special research.

BRITISH GUIANA. **Report on Recent and Present Veterinary Problems in British Guiana.** [HARRISON (J. B.), Director, Dept. of Science and Agriculture.]. MS. Report received by Colonial Office, 15th July 1920. 14 pp. f'cap.

Harrison, who holds the post of Director of Science and Agriculture in British Guiana, states that the country at the present time is singularly free from infectious and other diseases of live stock other than Texas fever. This disease is enzootic among cattle in the coastlands and consequently the cattle in the coastlands are of a relatively small, stunted type, as compared with the larger, more healthy-looking cattle found inland. All cattle imported into the coastland counties from Great Britain, Canada or the northern parts of the United States of America are attacked with this disease within 2 to 5 months of their arrival, and, as a rule, they quickly succumb. If they do recover they are generally useless for breeding purposes. This difficulty has been got over by importing high grade bulls and cows for the improvement of the local strains from the southern parts of the United States, where Texas fever is enzootic, and these animals are therefore almost immune towards infection with the local type of the disease.

In the '80's and '90's the coastlands cattle were often affected with severe outbreaks of anthrax. This disease was, however, brought under control by isolation of affected areas, together with compulsory inoculation with anthrax vaccine. Stringent steps are now taken by the Department of Agriculture whenever a sporadic case of the disease occurs. Nevertheless, recurrent cases continue to occur on two plantations and it was noted that the disease appeared on one pasture only of each estate. These pastures were specially treated; all animals on the estate were inoculated with vaccine and removed to and isolated on non-infected pastures. The cattle pens and byres were destroyed and the pastures all closed to cattle and completely flooded with water. The closure and flooding were continued for nearly two years, and these two estates have now been free from anthrax for over four years. The coastland districts have now been freed almost completely of anthrax by systematic and compulsory inoculation of all susceptible animals found within large areas around each outbreak.

Tuberculosis does not appear to be common among cattle, although information upon this point is not satisfactory.

Glanders is of rare occurrence in the coastlands and only 17 cases have been reported during the last eight years.

Cattle are stated to be subject to very acute attacks of trypanosomiasis, which invariably proves fatal in from 26 to 48 hours. Treatment of this disease was attempted by using a preparation called sodium protosanate, with good results.

Mal de caderas was first detected on a sugar plantation in Berbice in November, 1912. Horses were first attacked, in many cases with rapidly fatal results, and then the disease spread from the horses to the mules. Owing to a faulty diagnosis the disease was allowed to spread through the estates and every animal attacked died. As a few of the affected mules showed signs of recovery some owners were unwilling to protect their other animals by destroying at once those showing well-marked symptoms. In 1914 the Department of Agriculture adopted stringent precautions to prevent its further spread, by strictly isolating every affected plantation until the owners assented to the destruction of all diseased animals. In this way the disease was stamped out.

A few outbreaks of cerebro-spinal meningitis (in horses) were reported prior to 1913, but no cases have been identified since that year.

Occasional cases of contagious pleuro-pneumonia (in bovines) have been seen, but the spread of this disease has been readily prevented by adopting certain precautions. The mortality in the outbreaks varied from 14 to 25 per cent. of the animals attacked.

Only one case of dourine has been reported during the last 16 years.

Until April 1914 pigs were very free from disease. An outbreak of swine fever occurred on that date and lasted up to October of that year. Several thousands of pigs succumbed to it, but its spread throughout the colony was stopped by very severe isolation of the farms and districts where it occurred. No outbreak was reported during 1915, but in 1916 the disease again appeared in isolated areas in a certain district. Its further spread, however, was stopped by destruction of all infected animals and all pig pens and isolation of the farms on which it had occurred.

As far as can be ascertained the cattle in the pastoral districts of the hinterland are quite free from disease.

Dogs and cats are very subject to intestinal parasites.

The various laws dealing with infectious diseases of animals have recently been consolidated into one Ordinance (No. 5 of 1920). Likewise unnecessary cruelty to animals during surgical operations has been guarded against in a recently enacted law.

According to the census returns for the years 1915–1919 the average number of animals in the coastlands was :—horses 1,000, donkeys 6,400, mules 2,300, cattle 84,000, buffaloes 180, goats 13,200, sheep 21,600, pigs 13,200. In the inland savannah districts the estimated numbers were :—horses 600, cattle 30,000. The live stock on the coastlands are spread at intervals over an area having a frontage to the sea of 180 miles, with an average depth of about 7 miles. The

Government Veterinary Staff is at present sufficient to supply the needs of one county only. Up to 8 years ago there were at least six qualified veterinary surgeons besides the Government Veterinary Surgeon in the Colony, but now there is only one.

The defects in the qualifications of many locally registered veterinary surgeons are due to an Ordinance passed in 1909, which entitled any person who was engaged in practice to be registered as a veterinary surgeon. This Ordinance has now been repealed. There appears to be a notable deficiency in the number of trained veterinary surgeons in the Colony.

In coping with infectious diseases it is also a great disadvantage that the one veterinary surgeon remaining in the Colony is allowed to indulge in private practice. Funds do not appear to be adequate to engage the services of a whole-time veterinary surgeon.

The Sugar Planters' Experiment Station Committee have recently investigated this matter, and reported on the necessity of having a staff specially skilled in tropical diseases of live stock.

TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY BULLETIN.

Vol. 9.] 1921. [No. 2.

DISEASES DUE TO PROTOZOAN PARASITES.

Aldigé (E.). **Trypanosomiase du porc en Guinée française.** [Trypanosomiasis of the Pig in French Guinea.]—*Bull. Soc. Path. Exot.* 1920. Dec. 8. Vol. 13. No. 10. pp. 792–796.

Trypanosomiasis was described in pigs in French Guinea by Martin (G.) in 1906, and this author identified the parasite as *T. dimorphon,* although the long forms transmitted to the mouse are represented with a flagellum. Aldigé (now deceased) examined an outbreak of trypanosomiasis in a piggery belonging to a Mamou settlement in September 1914, during the rainy season. The outbreak appeared interesting on account of the rapid development of the disease, the extraordinary number of parasites in the blood of all affected animals, and the nature of the parasites. The animals were kept in a well-shaded place in a small valley. The only previously recorded occurrence of acute trypanosomiasis in the pig appears to be that of Ochmann (*Berl. Tierärztl. Woch.*, 1915, May 11), who found the condition in a herd of pigs in German East Africa, and the trypanosome, for which the name *T. suis* was proposed, was said to belong to the *dimorphon* group.

Symptoms appeared suddenly and developed with extreme rapidity. The temperature exceeded 40° C. and sometimes reached 41° C. at the onset. The animal lay prostrate on its side, indifferent to its surroundings. The appetite was, however, maintained. Death occurred in untreated animals sometimes within 12 hours, but usually in from 24 to 48 hours. In all animals the disease assumed a hyper-acute or acute form. Thirteen pigs out of a lot of 22 died within six weeks. The mortality ceased a few weeks after the transference of the herd to higher ground. Post-mortem, the usual lesions of trypanosomiasis, viz., enlarged spleen and petechiae on the serous membranes, were observed.

The parasites swarmed in the blood in all cases during the first few hours of the disease. They were found in abundance in one pig which was in perfect health two days previously and then showed no trypanosomes in its blood, and had only shown the first signs of the disease six hours prior to finding the positive result. In all cases the number of parasites increased up to the time of death, so that eventually the blood was haemolysed and appeared to be a pure culture of trypanosomes. Fixation of smears was difficult. In fresh preparations the trypanosome exhibited more active wriggling movements than does *T. dimorphon.* It also showed some translatory movements which, however, were much less marked than with *T. cazalboui* (*vivax*), and it remained within the field of the microscope. After fixation and staining with Giemsa, the trypanosomes were generally slender, with long flagella. Some forms measured 12 to 14μ, others were 21 to 25μ long ; the thickness was usually between 1 and 1·5μ. In the long forms the flagellum was much longer than in the short forms. Numerous intermediate forms were to be found. In some preparations short forms, reaching 2 to 4μ in width and possessing a very short flagellum, were to be seen, but these forms were very rare. A few very spherical-looking parasites were found composed of a protoplasmic mass with a flagellum, and containing a nucleus and a centrosome already divided into two. The majority of the animals had reached the agonal period when they were examined, and in these conditions the trypanosomes were extremely numerous, and undergoing division. Marked agglutination of the parasites was seen. Sometimes the posterior extremities of several parasites were attached to each other, and sometimes two or more were stuck together laterally for some distance. The posterior extremity was generally attenuated in the slender flagellated forms, and rounded in the short wide forms. The nucleus was situated at some distance from the posterior extremity in the former, but much closer in the latter. On morphological considerations the parasite is therefore not identifiable with *T. dimorphon* (*congolense*) or with *T. cazalboui* (*vivax*), but it appears to resemble more closely *T. pecaudi,* although the short forms observed do not correspond exactly with the typical short wide form without free flagellum of this species. The author considers that the parasite perhaps resembles still more closely *T. brucei,* although this species has not been found hitherto in French Guinea, but a closely-related form, *T. togolense,* has been found in Togoland. [We are not aware of any substantial differences between the three last-mentioned forms, and morphologically there is good reason for relegating this trypanosome to the so-called *brucei-pecaudi* group.—Ed.]

Experimental inoculations were not performed. One chronic case was observed in a sow, which showed rare trypanosomes only once in its blood. The animal became very thin, and developed paresis of the hind quarters and unsteady gait, with arching of the back. The appetite was maintained. This sow had been imported two months previously from a district where *T. pecaudi* is frequently encountered in several species of animals. It seems probable that this animal originated the infection in the herd.

Some of the pigs were submitted to treatment by the administration of orpiment, and 0·5 to 1 gm. daily of this drug for three days brought about the disappearance of the parasites. One boar, showing abundant trypanosomes in its blood, was given 1 gm. of orpiment, and on the following day the parasites were much less numerous, and short wide forms which were rare on the previous day appeared. The drug was then administered daily for three days in 2 gm. doses, after which the trypanosomes disappeared completely. Doses were then given twice only per week. The pig seemed to be cured, and treatment was dropped by the owner. The pig died suddenly, however, 19 days after the first attack. Another, a young sow, which was given

0·5 gm. of orpiment every day for three days, appeared to be cured and the parasites disappeared.

For three consecutive days orpiment was then given in doses of 0·25 to 2 gm. daily to the whole herd, according to the age and weight; mortality ceased and all the animals seemed to acquire good health. The author advised the administration of orpiment three times a week to the whole herd, but the treatment was not continued by the owner, with the result that a few deaths again occurred subsequently, from a fortnight to a month afterwards. The sow treated with orpiment succumbed suddenly about 20 days after the first attack.

Treatment with tartar emetic and orpiment was tried in another young sow: First day, 0·1 gm. emetic; third day, 0·5 gm. orpiment; fifth day, 0·1 gm. emetic; seventh day, 0·5 gm. orpiment; ninth day, 0·1 gm. emetic; eleventh day, 1 gm. orpiment; fourteenth day, 1 gm. orpiment, subcutaneously. Treatment was then discontinued. The parasites disappeared in two days after the first injection of tartar emetic and the animal recovered.

One sow, affected with a more chronic form of the disease, was treated with tartar emetic alone by the administration of four injections subcutaneously at three-day intervals of 0·1 gm. tartar emetic in 1 per cent. solution. Three months afterwards the animal was in good condition and its locomotor troubles had disappeared. The subcutaneous injection of this solution did not cause much disturbance in the pig beyond a transient, sometimes fairly marked, local inflammation. It did not produce large firm swellings, as the drug does in the horse, or any necrosis and sloughing, as in the dog.

HORNBY (H. E.). **The Relative Pathogenicity for Cattle of** *Trypanosoma congolense* **and** *T. vivax*.—*Vet. Jl.* 1921. Feb. Vol. 77, No. 2, pp. 77–78.

During 1920 Hornby had under observation on the Tanganyika Plateau a number of herds of native cattle affected with trypanosomiasis. Examination of one affected herd in particular showed that the animals varied in condition, some being in an excellent state of fitness and others emaciated. It appeared that although many cattle had died, a number of those in good condition at the time of examination had been sick and had recovered. Several affected cows aborted or gave birth to weakly calves, but if the beast were young and the grazing good she might again pick up in condition and rear her calf. Some recovered animals suffered from relapses and died.

The blood and gland juice of 30 cattle affected with the disease or said to have recovered were examined microscopically. No trypanosomes were found in any beast which did not show clinical symptoms of the disease, even when it was said to be a recovered animal. Sixteen cows were found to harbour trypanosomes; 10 of these disclosed *T. congolense* (in gland juice only 1, in blood only 2, in both blood and gland juice 7); six harboured *T. vivax* (in gland only 3, in blood only 1, in both blood and gland 2). It would thus seem that *T. vivax* infection can be overlooked when the blood only is examined. The glands usually examined were the prescapular glands.

Four young cows affected with *T. congolense* and four affected with *T. vivax* were picked out and left under the ordinary conditions of village management at the time of the year when grazing was still plentiful. Three months later all four *T. congolense* animals were dead. Of the *T. vivax* animals one had died, one was very thin (with blood and gland juice positive), and two appeared to have recovered. In order to test the immunity of these two recovered animals they were injected subcutaneously with blood rich in *T. vivax*. Eight days later they were decidedly ill and their blood was heavily infected.

A heifer in good condition, but stated to have been ill and aborted a year previously, was injected with two strains of *T. congolense*, with the result that she rapidly became diseased and died a month later.

Hornby therefore concludes that in some districts a number of native cattle recover spontaneously from *T. vivax* infection, but that no high degree of immunity results therefrom.

PUNJAB. **The Annual Report of the Camel Specialist** [CROSS (H. E.)] **for the Year 1919-1920.**—11 pp. 1920. Lahore: Supt. Govt. Ptg. [Price R.0·3 or 4*d*.]

The laboratory of the camel specialist was re-transferred from the Military Department to the Civil Authorities on September 1, 1919.

Courses of training were given to Sarwans from various camel corps, and 80 camels belonging to private owners were treated during the year for various diseases.

Surra Treatment.

Some experiments on the treatment of surra in camels by means of tartar emetic were carried out by Cross in the early part of 1917 (see this *Bulletin*, 1920, Vol. 8, p. 179).

Further experiments carried out on a large number of camels during the cold weather of the year under report are claimed to have furnished the following results :—Ten doses of 60 cc. of a 1 per cent. solution given intravenously to full-grown camels of average size do not effect a cure in the majority of cases. Likewise one large dose of 600 cc. of a 1 per cent solution, given intravenously in three injections of 200 cc. each with two or three-hour intervals between the injections, did not result in a cure. On the other hand, ten to twelve doses, given on alternate days, commencing with 150 cc. of a 1 per cent. solution and increasing to 300 cc., gave very promising results. However, it is admitted that these camels must be kept under observation for a period extending over at least a year and their blood tested by inoculation into small animals before it can be claimed that an actual cure was obtained. It was found that fainting was not so liable to occur if the first injection of tartar emetic was given when the trypanosomes were absent from the peripheral circulation, that is to say, when the temperature was not high. The action of antimony trioxide and other drugs in surra treatment is said to be under investigation.

Some remarks are made with regard to the course that surra, either naturally or artificially contracted, runs in camels. Many Punjabi camel men maintain that camels, once infected, never recover, while, on the other hand, many camel men are of the opinion that if the infected animal lasts over three years it finally recovers, improves in condition, and finally becomes immune towards the disease. To ascertain the course that surra runs in camels when it is naturally contracted 11 camels suffering from surra and in fair condition were obtained from the Sillader Camel Corps in the latter part of 1914 and early part of 1915, and it seemed that these animals had contracted surra during the 1914 fly season. They were kept under most favourable conditions, submitted to no work, and, in addition to browsing, given a ration of grain and bhoosa. The blood of each camel was examined daily and a record kept of the presence or absence of trypanosomes. Up to the end of the year under report (March 31, 1920) ten out of the 11 camels had died, and the surviving animal was in poor condition and likely to die during the next period of cold weather.

In addition to these 11 camels seven other camels belonging to a villager who lived near Sohawa were diagnosed on September 29, 1913, to be suffering from surra. During the cold weather these seven camels were worked by the owner in the Ambala and Amritsar districts, but during the hot weather they were not worked. Within 1½ years two males had died and the dachi had aborted; within 2½ years five had died; in less than 3 years all seven had died.

In order to ascertain whether there is any difference in the course of the disease when it is contracted by artificial inoculation, four young camels aged from 2½ months to 1 year and one camel aged 18 years were inoculated with 1 cc. of infected blood. The camels were kept under the same conditions as those that had naturally contracted the disease and the blood was examined daily. The 18 years old camel died 18 days after the inoculation, but the four young camels were all alive and in fair condition on March 31, 1920. In other words, three one year old camels were still alive after four years five months and eleven days, and one 2½ months old camel after two years ten months and four days.

Cross concludes that the time an infected camel lives probably depends to a great extent upon the age at which it becomes infected. Further, it is unlikely that camels infected after the age of six years and worked ever recover from the disease. Whether animals that become infected when they are very young recover still remains to be ascertained.

In the early stages of surra the paroxysms were, in the majority of cases, far more frequent than in the later stages, and in the later stages diarrhœa was a frequent symptom. Mange produced very rapid loss of condition in the infected camels. Swelling and suppuration of the inguinal glands were frequently seen. Stall-fed camels often fed well even during the paroxysms, but when they were out browsing during the paroxysms they did not feed well, did not go from tree to tree like a camel in normal health, and were obviously sick. Oedema of the belly and legs was sometimes seen.

During the investigations into surra amongst the Camel Corps and other military camels it had often been noticed that ponies and mules kept in close proximity to a large number of camels suffering from surra during a fly season exhibited practically no cases of the disease. It appeared possible that the ponies did not become infected, or that they did not develop the same symptoms when infected with camel surra as when they were suffering from horse surra. It was decided, therefore, to ascertain the course camel surra runs in ponies and other animals, and with this object in view ponies, buffaloes, goats, sheep, dogs, rabbits and guinea-pigs were inoculated with blood from infected camels.

Ten ponies of various ages were inoculated. Two ponies, one aged 1 year and the other 6 months, were alive when reported upon over three years after inoculation; one, 8 months old, died in just over

2½ years, while the others, which varied in age from 3½ to 18 years, succumbed at intervals extending from 43 days to 1 year 5 months from the time of inoculation. The results appeared to show that infected ponies do not often lose condition, and do not always die from gradual emaciation. On the contrary, they frequently put on condition and live for several years when not made to work. In some cases in the later stages of the disease the intervals between the paroxysms were very long, extending to more than a year. Constipation, colic, partial paralysis of the hind-legs and brain symptoms were frequently met with. Death from paralysis of the hind-legs has been reported in ponies attached to camel corps, and it is therefore not impossible that such animals died from camel surra.

Six buffaloes, three 5 years old, three 6 years old, were inoculated with infective camel blood and did not die from surra, and trypanosomes did not frequently occur in the blood. Even when no trypanosomes could be found in the blood, it could, nevertheless, be demonstrated to be infective. In two buffaloes the blood was infective for rabbits and guinea-pigs when tested 163 and 172 days respectively after the inoculation. This distinctly proves that buffaloes can act as dangerous reservoirs of surra; it was noted that Tabanidae were frequently seen sucking the blood of these animals. The buffaloes did not lose condition after the inoculation.

Dogs (five inoculated) showed very little resistance to the disease, and died within two months. They became greatly emaciated, and showed a great tendency to develop eye lesions.

Two goats were inoculated, and did not subsequently die, although they were kept under observation for 999 days. They did not lose condition, and trypanosomes were seldom found in their blood. They were only found once in one animal, 107 days after inoculation. The blood, nevertheless, could be demonstrated to be infective, for blood taken from one goat 309 and from the other 321 days after inoculation proved virulent.

Sheep (five inoculated) proved susceptible to inoculation, but trypanosomes were very infrequently found in the peripheral circulation, although the blood could be demonstrated to be infective by inoculation. The sheep became gradually emaciated as the result of the disease, and finally died. Sheep and goats, however, are not such dangerous reservoirs of the disease as buffaloes are, for they are seldom attacked by Tabanidae. Camel surra gave rise to a fatal infection in guinea-pigs and rabbits. The rabbits (two) succumbed in 180 and 84 days respectively; the guinea-pigs (three) in 17, 75, and 68 days respectively.

An examination of all privately-owned camels throughout the Punjab has been commenced, with a view to ascertaining the number infected with surra, as this result should be capable of furnishing some idea with regard to the percentage infected in the Province, and also of the areas where surra is most prevalent.

Breeding of camels has decreased, greatly owing to the fact that large areas of rakhs have been closed up by forest legislation, and extensive tracts of land which were previously available for this purpose have been reclaimed by the Canal Department. It is maintained that unless steps are taken for the encouragement of camel breeding, it will be very difficult in the future for the Military Authorities to obtain sufficient remounts for the Camel Corps. The Punjab *pahari* camel, which is the most suitable for frontier work, is becoming very scarce, and steps should be taken to prevent this type of camel from becoming extinct.

WATSON (E. A.). **Dourine in Canada, 1904–1920. History, Research, and Suppression.**—Dominion of Canada, Dept. of Agriculture, Health of Animals Branch. 43 pp. With 9 plates (2 coloured) and 14 charts. 1920. Ottawa: Thomas Mulvey, Printer.

In this interesting monograph Watson presents a succinct account of Canadian experience with dourine, an experience extending over a period of 15 years, and covering the study and suppression of a rare and serious disease previously unknown in Canada. It is well to bear in mind that although the disease is one of the oldest recorded in veterinary literature, and has been known to the Arabs and in certain countries of Asia and Africa for centuries, it is only within the past 25 years that its nature has been recognised.

The causal agent, *Trypanosoma equiperdum*, was seen for the first time by ROUGET in 1894. The specificity of this parasite was for a long time, however, contested by many workers in Europe, and the question was still in dispute ten years later, when the disease made its first appearance in Canada. In March 1904 Inspector BURNETT, Chief Veterinary Officer of the Royal North-West Mounted Police, reported the existence of the disease in a stallion and several mares located near Lethbridge, Alberta. The Veterinary Director-General (RUTHERFORD), HARGRAVE of Medicine Hat, DAVISON of the United States Bureau of Animal Industry, and other veterinarians, examined the affected animals and agreed upon the diagnosis. From inquiries made in the neighbourhood, it appeared probable that the disease had been introduced several years previously, and there appears to be good reason to attribute its introduction to the importation of animals from the Western United States, where among range animals the disease had been known to exist from time to time.

A quarantine station of 1,800 acres of fenced land was thereupon established near Lethbridge, where all suspected animals were gathered in and kept under observation. Regulations relating to the disease were formulated and brought into force under the provisions of the Animal Contagious Diseases Act, 1903, and slaughter of infected animals and payment of reasonable compensation to owners were enacted. The quarantined animals were re-examined after a period of several months, when it was anticipated that acute or well-marked symptoms of the disease would have developed. RUTHERFORD reported that, instead of finding an aggravation of symptoms and a progressive state of disease, he was surprised to discover that there were no well-marked cases, that many of the affected animals had greatly improved, and that there was not among them any one case sufficiently pronounced to warrant an order for its destruction. Doubts began to arise as to whether the disease was actually dourine or some other condition. Many examinations of blood and other body fluids obtained from infected animals were made in the field, and specimens were sent to various laboratories, but no trace of the presence of the parasites, or any definite information as to the nature of the disease, was revealed. RUTHERFORD drew attention to the fact that dourine, an indigenous disease in Asia and Africa, had become more irregular in its course and manifestations in Europe and America, and had probably become still further modified under the peculiar climatic conditions of the North-West Provinces of Canada. It was decided not to adopt immediately a policy of slaughter, but to retain the suspected animals during a further period in quarantine until more satisfactory evidence was obtainable, and also in order to acquire as much information as possible regarding the behaviour of the disease in Canada.

In May 1905 the animals were again examined by RUTHERFORD and other veterinary officers. In some animals the disease was found to have progressed, while in others there was but little change from the conditions noted on previous occasions. One hundred and sixteen horses were destroyed and a considerable number were retained for further observation. Special officers were detailed to deal with the disease and were authorized to order the slaughter of any well-defined cases that came under their notice. In September 1905 it was decided to slaughter all the animals at the Quarantine Station with the exception of a few that had been under observation for more than twelve months and appeared to be healthy. It was then arranged to utilize the Quarantine Station for experimental work in connection with dourine, with HADWEN in charge, and a number of condemned animals were placed at his disposal. Three infected animals were sent to the Biological Laboratory, Ottawa, for study. Investigations were continued in the field and in the laboratories in the winter of 1905 and in the following summer. The disease was found to exist in various parts of Southern Alberta, and by the end of October 1906, 412 animals had been destroyed.

At the Lethbridge Quarantine Station breeding experiments were conducted in order to find out whether apparently recovered mares would bear healthy foals or remain sterile. Diseased and healthy stallions were employed. Several slightly affected mares were spayed, as it was hoped that such cases could be spared destruction and usefully employed for working purposes only. Search for the trypanosome was kept up continuously by microscopic examination and inoculation of dogs and other laboratory animals with blood and material obtained from diseased tissues, with invariably negative results. At Ottawa, HIGGINS and WATSON made a cytological study of the blood of dourine horses for purposes of comparison with normal horses and horses suffering from certain diseases. It was found that the leucocyte formula in dourine presented certain peculiarities and was of some diagnostic value. A pathogenic trypanosome, *T. gambiense*, was maintained and studied in a series of laboratory animals, mainly with the object of acquiring a knowledge of the habits and characteristics of such organisms. In October 1906 WATSON undertook the investigation of dourine and became stationed at Lethbridge. In November and December of this year he discovered trypanosomes in the blood of native "cotton-tail" rabbits and in a species of northern deer-mouse caught on the Quarantine grounds at Lethbridge. This finding represented the first record of trypanosomes in mammalian blood in Canada.

T. equiperdum was actually discovered by Watson in February 1907 in an affected mare. The reproduction of the disease by inoculation of these parasites into healthy horses and the recovery of the parasites from the typical lesions produced removed all doubt as to whether the dourine of America was a trypanosome disease or not, and the identity of the condition with the dourine of Asia and Africa and of European countries was clearly established.

However, in Africa and Asia, where the disease exists in its most severe form, no great difficulty seems to have been encountered in detecting the parasite or in diagnosing the disease by its clinical manifestations. In Europe, on the contrary, search for the trypanosome was for many years unsuccessful. The course of the disease was found to be irregular and uncertain, and diagnosis as a rule had to be based on clinical symptoms, which as often as not were too vague and elusive to permit of satisfactory conclusions.

In America it became evident that the disease occurred in a still more insidious form, and that frequently no characteristic symptom or premonitory sign was presented in the early stages, which might become prolonged over very long periods. Moreover, the condition appeared to be far removed from being invariably a fatal disease; many infected mares retained or recovered apparent good health, although they were suspected of being capable of transmitting the disease to the covering stallion. The better bred, and especially the pure-bred imported, animals of high commercial value were usually the most severely affected and the first to succumb. Prairie-bred animals of the native pony and broncho types were best able to resist or tolerate the infection and thus become carriers; in the absence of any reliable means of diagnosing these cases they constituted a frequent and dangerous source of infection, for at this time large numbers of horses lived and bred on the open ranges, where natural conditions all favoured the spread of the disease. The prospect of eradicating the disease therefore, in view of the apparently insurmountable difficulties in diagnosis, did not seem encouraging.

During the next five years 1907–12 cases of dourine were discovered in a number of breeding districts in the Provinces of Alberta and Saskatchewan, by GALLIVAN and HAWKE. When an animal was found affected the fullest possible history of the case was secured, all animals which had been in contact by breeding were traced, and sick animals were placed in quarantine for an indefinite period, and they were not allowed to be bred from, sold, or removed, without special licence. Periodical examinations were made by the inspectors in charge, and as soon as a clear case of the disease had developed the animal was destroyed. It happened quite frequently, however, that no definite symptoms could be seen until the disease had run its course for nearly two years, and consequently horse breeding among such groups of animals, often numbering several hundred, had to be prohibited for two and sometimes three years in succession. Even then it was not always certain that some latent case had not been detected, and subsequent evidence demonstrated that in large outbreaks of dourine, especially among prairie-bred animals, such carriers almost certainly do remain and can only be detected by specific means of diagnosis.

Although no better measures of control could be devised in the circumstances, the prolonged quarantine for observation purposes, the periodic examination by veterinary inspectors, and the maintenance of large breeding establishments or herds of breeding mares which could not be used for breeding purposes, proved costly, onerous, and unsatisfactory. A large amount of research work was therefore accomplished during this period. Several strains of the trypanosome were in the meantime obtained from different outbreaks. Parallel series of experiments were made with the different strains in a close study of the pathogenicity, life-history, and variations in the virulence of *T. equiperdum*. The strains were maintained in horses, the evolution of the disease in its various phases was followed from year to year, and many observations and experiments were made upon the survivors. Mares which had spontaneously recovered, some from a natural and others from an experimental infection, were successfully bred from and raised healthy foals year after year. It was found that these mares resisted reinfection and that the serum of such animals possessed immunising properties. The experimental treatment of dourine was investigated both from a preventive and curative point of view. Immunising sera and special drugs recommended in other trypanosome diseases—for example, atoxyl and arsenophenylglycin—were employed and reported upon. The chief object of the researches, however, was to determine a precise method of diagnosis, and thus the serum of affected animals was subjected to continuous study. Serum reactions and serum methods of diagnosis were worked out, and included a serum-globulin test, a trypanosome agglutination test, and a precipitation test. Of these the agglutination test was the most satisfactory, but did not meet all requirements. Watson spent the winter of 1911 and 1912 in studying trypanosome diseases in European laboratories. A German strain of dourine and an African strain were obtained from the Imperial Health Institute, Berlin, and brought to Canada for comparative work.

In 1912 considerable progress was made in serum diagnosis by adopting the complement fixation (or deviation) test. After several modifications and improvements in technique were made this test was found to provide a specific, precise, and uniform method of testing. As a means of diagnosis it answered all requirements, and came into general use in 1913 (for description of this test see this *Bulletin*, 1915, Vol. 3, No. 4, p. 118). Towards the end of that year a recurrence of the disease was reported in the southern districts of Alberta. Field investigations showed it to be very widespread, and to cover the old centres of infection of the first known outbreaks that had occurred 6–8 years previously. On one company's ranch 2,718 horses were involved, including a number of imported stallions and mares. Blood was collected from every animal and sent to the laboratory. As a result of the first test over 400 animals were declared infected. Some scepticism was at first evinced by the owners, inasmuch as animals that were apparently in good health were condemned as a result of a positive serum reaction. However, when many of these animals commenced to show symptoms and several died all opposition vanished, and the owners became quite willing to have their animals slaughtered and compensated for, and co-operated readily in stamping out the disease.

The complement test has since been employed wherever the disease has made an appearance in the country. It is stated to have proved of inestimable value as the main factor in the diagnosis and suppression of the disease, enabling an early and definite decision to be made. It is now quite sufficient to apply the test and re-test after a short interval in order to eliminate any doubtful reactors.

It was fortunate that this test was available when a widespread recurrence of the disease occurred in 1913–16. During this period every effort was made to cover the whole field of the disease, and it was then that the heaviest toll was paid in slaughter and compensation. The large Indian reservations situated within the infected area of Southern Alberta had been for a long time suspected of harbouring dourine. It was rarely possible to detect a case among the native ponies, but cases were frequently found among the better-bred animals of the neighbouring ranches, which from time to time strayed on to the Indian ranches. A serum test of these Indian horses indicated many cases of hidden affection and of dourine carriers. This was not surprising, as the constantly intermingling herds, the Indian's habit of letting young stallions grow uncastrated until they had reached the age of three or four years, and promiscuous breeding, had given every facility for spreading the infection. In order to stamp out this last-remaining source of infection the droves were collected together and tested repeatedly, at intervals of six months to one year, and animals that gave a reaction to the test were destroyed. In connection with the serum diagnosis of dourine over 40,000 laboratory tests were made during the period 1911–20. From the time the disease first came under departmental action up to the date of writing (1904-20) 1,933 horses had been destroyed (1904–5, 292; 1905–6, 120; 1906–7, 167; 1907–8, 49; 1908–9, 28; 1909–10, 37; 1910–11, 40; 1911–12, 18; 1912–13, 18; 1913–14, 471; 1914–15, 394; 1915–16, 228; 1916–17, 48; 1917–18, 16; 1918–19, 5; 1919–20, 2).

Watson declares that in 1920 dourine appeared to have been totally suppressed in Canada. Moreover, if further outbreaks should occur, or the disease be reintroduced, it would never be allowed the opportunity of gaining much headway now that there are means at hand of detecting it, either in its initial or active stages, or in its latent or hidden forms. The disease can thus be dealt with promptly and effectively.

Finally, the testing of all stallions imported into Canada, and stallions that are travelled through the country for breeding purposes, would prevent the reintroduction of the disease and afford an adequate protection to the horse industry.

Watson closes his account of the disease with a series of excellent figures depicting the symptomatology and lesions and the causal organism.

STIRLING (R. F.). **Existence of** *Trypanosoma dimorphon* **in Central Provinces, India.**—*Vet. Rec.* 1921. Jan. 22. Vol. 1. (New Series.) No. 4. p. 71.

This short note is of particular importance, inasmuch as it may prove to be a record of the first described case of *T. congolense* infection in India. In June 1920 a bullock died under conditions which suggested trypanosomiasis, and blood smears were examined microscopically. Trypanosomes were found in large numbers, and they differed morphologically very considerably from *T. evansi*. They appeared to the author to resemble organisms of the *dimorphon* (or *congolense-pecorum*) group, and a smear was sent to the Veterinary Research Laboratory of the Union of South Africa in order to obtain confirmation of this point. The Acting-Director reported that numerous trypanosomes were found belonging to the same group as *T. dimorphon*. The parasites varied from 11 to 18μ in length, average 14·5—measurements agreeing very closely with those attributed to *T. nanum*.

VAN SACEGHEM (R.). **La Trypanosomiase du Ruanda.** [Trypanosomiasis in Ruanda (Belgian Congo).]—*C. R. Soc. Biol.* 1921. Feb. 5. Vol. 84. No. 5. pp. 283–286.

A serious outbreak of trypanosomiasis is raging at the present time among the large herds of cattle in the Kissengnie District of the Ruanda Province, and this outbreak furnishes still another example of transmissibility of trypanosomiasis in the absence of tsetse fly. The altitude of this region everywhere exceeds 1,400 metres and tsetse nowhere exists. The disease appears to be of quite recent introduction, and, in fact, there is evidence that it was introduced by mules belonging to the Military Forces during the period of the war, and the disease became propagated thereby from herd to herd throughout the whole country.

When examined in the fresh state the trypanosomes are stated to exhibit polymorphism, show no free flagellum, and are actively motile, although they show no tendency to pass out of the field of the microscope. In stained smears made from the blood of naturally infected cattle they measure from 9 to 16μ long by 1·5 to 2μ broad, although sometimes they may reach 3μ when the undulating membrane is also included. The posterior extremity is rounded, the cytoplasm is generally homogeneous, but sometimes a few chromatinic granules are found in it. The centrosome is well marked, the undulating membrane is well developed, but is not often folded. The name *Trypanosoma ruandae* is provisionally allotted to the organism although it is admitted that further study may prove that it is quite indistinguishable from *T. congolense* (*pecorum-dimorphon*), with which it is morphologically very similar.

The trypanosome is pathogenic for cattle, sheep, guinea-pigs, and also for the equidae. Cattle affected clinically with the disease show all the signs of a progressive anaemia, enlargement of the lymphatic glands, and often a swelling of the eyelids, with a serous discharge from the conjunctiva. The naturally occurring disease was encountered only among cattle. There are very few equidae in the district, and thus it was not possible to ascertain whether the trypanosome was pathogenic for these animals. It was found possible to infect a native sheep experimentally, and trypanosomes appeared on the seventh day after injection of virulent blood. A guinea-pig was easily infected and showed trypanosomes on the eighth day. Attempts at cultivation in simplified Novy medium gave negative results, although the trypanosomes could be kept alive for 90 hours at 23° C. in this medium, and when examined they were found to have become agglutinated in masses.

There is good reason for believing that the vectors of the parasite are Stomoxys, which are very prevalent in the district at all seasons. It was quite easy to ascertain the presence of live trypanosomes in the intestines of this fly after it had been taken from animals infected with the disease, but on the following day the trypanosomes were found to have disappeared from this situation. The presence of living trypanosomes in the intestine of a fly after a meal on an infected animal proved that the salivary secretion of the fly is not injurious towards the trypanosomes, but, nevertheless, the organisms could not be found in the proboscis of the fly after persistent search.

In 1915, Van Saceghem recommended intra-muscular injections of tartar emetic for the treatment of trypanosomiasis in animals [see this *Bulletin*, 1916, Vol. 5, No. 1, p. 21]. The method at present adopted by him has been slightly modified. A solution of 4 per cent. tartar emetic is made in distilled water, and to this is added 4 per cent. of chemically pure sodium chloride. The addition of common salt is claimed to obviate the formation of the marked albuminous precipitate which becomes formed when a strong solution of tartar emetic is added to a serous fluid, and the irritant and necrosing action of the substance is thereby diminished. A small incision is made in the skin prior to the insertion of the needle. This form of treatment is stated to have given immediate good results and no further deaths occurred. Five intra-muscular injections are given at five-day intervals; the treatment is then suspended for 15 days and a microscopic examination made of the blood.

SERGENT (Edm. & Ét.) & FOLEY (H.). **Essais de traitement du debab, Trypanosomiase des dromadaires. I. Afridol—II. Trypanobleu—III. Émétique et Atoxyl.** [Experiments in the Treatment of the Trypanosomiasis of Dromedaries known as Debab. I. Afridol.—II. Trypanblue.—III. Tartar Emetic and Atoxyl.]—*Ann. Inst. Pasteur.* 1921. Mar. Vol. 35. No. 3. pp. 204–206.

—— DONATIEN (A.) & LHÉRITIER (A.). **IV. Étude de l'action de l'émétique.** [A Study of the Action of Tartar Emetic.]—*Ibid.* pp. 207–211.

I. *Afridol Cl.*—A benzidine dye recommended by NICOLLE (M.) and MESNIL (F.) (O. dichlorobenzidine + Acid H), called in short Cl. This drug was injected into a female that had been infected experimentally three weeks previously. First dose 3 gm., second dose 4 gm. (15 days later), third dose 3 gm. (one month later), fourth dose 3 gm. (15 days later), fifth dose 2 gm. (one month later). Total 15 gm. in four months, subcutaneously. The trypanosomes did not disappear for long after the injections, but the general condition of the animal became quickly re-established. At the end of four months, from the clinical aspect, the recovery was perfect. After two to three years the blood ceased to be infective, and the animal became resistant to repeated massive infection with infective material.

A second dromedary infected experimentally was treated after the disease had been in progress one month, and trypanosomes were numerous. The dose amounted to 14·3 gm., given in five injections covering a period of five months. No effect was produced upon the number of trypanosomes or upon the general condition, and the animal died two months after the treatment had ceased, with trypanosomes in its blood.

II. *Trypanblue.*—Recommended by NICOLLE (M.) and MESNIL (F.) (O. tolidine + Acid H), called A in short.

A naturally-infected dromedary was administered 4 gm. per day three times in succession, with two-day intervals, but the trypanosomes did not disappear from the blood for more than four days. A second naturally-infected dromedary was first treated with three doses of 4 gm. each, given at two-day intervals, but the trypanosomes did not disappear for more than three days. A second attempt was made six weeks later with the same dosage, but again the organisms did not disappear for more than a few days. The animal died the same month, after having continuously shown numerous parasites in its blood.

A dromedary weighing about 350 kilogrammes was infected experimentally, and 2½ months later 7 gm. of trypanblue were injected. This dose proved toxic, the animal dying within 24 hours.

III. *Tartar Emetic and Atoxyl.*—A dromedary was infected experimentally, and numerous trypanosomes were frequently seen during the ensuing five weeks, after which a mixed form of treatment was commenced; for three weeks 2 gm. of tartar emetic were injected intravenously each week, and three days afterwards 3 gm. of atoxyl were injected subcutaneously. The trypanosomes disappeared after the first injection. The dromedary made a clinical recovery, but it had to be sold after three months on account of the war.

A second dromedary was treated in the same manner as the preceding one, and subsequently made identical progress. These two dromedaries lived under natural conditions on the Sahara grass lands, and they were examined twice a week.

The authors conclude that with the doses employed Afridol Cl. produced recovery in one out of two cases, trypanblue proved a failure, whereas the combination tartar emetic and atoxyl appeared to be efficacious

IV. *A study of the action of tartar emetic.*—In view of the above good results obtained in 1914 after the use of tartar emetic in debab, systematic experiments with the drug were undertaken. First of all the tartar emetic was examined as to its purity and especially as to its freedom from arsenic. It was employed in treatment dissolved in lukewarm distilled water 1 part in 200, and injected slowly intrajugularly—an operation which is easily performed in the dromedary.

(*a*) Action of a single dose.—Preliminary experiments were made on seven dromedaries. It was found that doses above 1·5 gm. were capable of killing a dromedary 300 kilogrammes in weight in less than 24 hours; 1·5 gm. and smaller doses were well tolerated; 0·5 gm. was not sufficiently active against trypanosomes; 1 gm. caused the trypanosomes to disappear from the blood, and the temperature became lowered, for eight days; while 1·5 gm. produced this effect for 10 days. It was therefore concluded that the dose that should be adopted was 1 gm.

(*b*) Action of repeated doses.—Since the trypanosomes reappeared in eight days on an average after the injection of 1 gm. of the drug, the second injection should be performed eight days after the first one. A series of four injections at weekly intervals therefore seemed indicated, and the animal was then to be allowed to rest. In the event of the trypanosomes reappearing in the peripheral blood this plan of treatment should be repeated.

The first investigation carried out on these lines was performed on nine dromedaries infected experimentally in the laboratory. The blood was examined and the temperature taken daily. After an acute infection had been manifested for one or two months, with fever and very frequent appearance of trypanosomes in the blood (15 days out of 30 on an average), six of these dromedaries were taken and given the first series of four injections according to the above plan; the three other dromedaries were kept back as controls.

Of the controls, one showed trypanosomes after 18 months, another after 20 months, while the third died of trypanosomiasis in 15 months. In the case of the treated dromedaries the medication proved successful in four and unsuccessful in two cases after 20 months' observation. The four cases represented clinical recoveries, as evidenced by complete disappearance of trypanosomes from the blood when examined microscopically. One dromedary recovered after four series (*i.e.*, in nine months with 17 gm. emetic); a second after five series (*i.e.*, nine months with 20 gm.); a third after six series (*i.e.*, in 10 months with 24 gm.), and the fourth after seven series of injections (*i.e.*, in 11 months with 28 gm.). Success was therefore claimed to have been obtained by the intravenous injection of tartar emetic amounting on an average to 22 gm. (in five series), covering a period of 10 months. An average dose of 2·2 gm. per month repeated during 10 months is therefore not toxic and may prove efficacious in treatment.

In the two unsuccessful cases, trypanosomes persisted in the blood. One of these cases was given 10 series of treatment (39 gm.), covering a period of 12 months. Trypanosomes reappeared 22 days after the last injection and persisted, as in the case of the controls, up to the time of death, which took place during the fourteenth month and was partly attributable to tartar emetic poisoning. The second failure occurred likewise after 10 series covering 12 months (38 gm.). The trypanosomes reappeared 20 days after the last injection, and subsequently were manifested as in the controls. A dose of 3·2 gm. per month repeated for 12 months is therefore stated to be toxic and inefficacious.

A point worthy of notice is that in the case of the four successful attempts the treatment was commenced somewhat later during the course of the infection than in the two cases in which the drug proved of no value. It is quite feasible to suppose that broods of trypanosomes resistant towards these drugs are created when the treatment is applied early.

The most striking symptom exhibited by females in the course of this disease is the constant occurrence of abortion during the acute phase of the infection, while the most noticeable sign of recovery in females treated with tartar emetic is the fact that pregnancy is accomplished normally. Three pregnant females infected experimentally in 1919 each gave birth to a dead young dromedary at full term, while a fourth animal affected with the chronic form of the natural disease gave birth to offspring which succumbed on the fourth day. However, in 1920, two of the female camels that had been successfully treated in the manner described above gave birth to quite healthy young.

The authors conclude that tartar emetic possesses great advantages when used in treatment on account of its low price and the ease with which it can be employed, viz., by intravenous injection, in the dromedary. But it has to be borne in mind that subtoxic doses sometimes have no action upon the trypanosome. There is thus room for investigation on combinations of tartar emetic with some other drug.

HOARE (Cecil A.). **Some Observations and Experiments on Insect Flagellates, with Special Reference to Artificial Infection of Vertebrates.**—*Parasitology.* 1921. Mar. Vol. 13. No. 1. pp. 67–85.

The first part of this work deals with the sheep ked flagellate (*Crithidia melophagia*), and its relation to the sheep trypanosome. A considerable amount of fairly exhaustive work has already been done on this subject since WOODCOCK, in 1910, discovered the natural occurrence of the trypanosome in the blood of British sheep, and BEHN confirmed these findings in 1911 and 1912 in Germany. The ked flagellate was studied in detail by SWINGLE in 1909 and PORTER in

1910, who concluded that it was a specific insect parasite, and that it was transmitted through the keds hereditarily, so that a second host, viz., the sheep, did not seem to be necessary. A large number of attempts at transmitting the flagellate to the sheep resulted negatively in SWINGLE's hands (1911). The presence of flagellates in young keds was therefore attributed to hereditary transmission (FLU, SWINGLE, PORTER). It had been shown that the number of trypanosomes in sheep's blood was, at all events, very scanty, and in most cases escaped detection by microscopic examination. CRAWLEY (1909 and 1912), however, showed that it was possible to cultivate trypanosomes from the blood of cattle when they could not be detected by ordinary methods, and this observation has been confirmed by many authors. Lately some very careful work has been done on this subject by NÖLLER (1917, 1919, 1920) in Germany, and by using special culture media and methods this author succeeded not only in cultivating trypanosomes from the sheep's blood, but also in bringing about the transition from the crithidial forms to trypanosomes in vitro. He thus appeared to have established the identity of the two forms beyond doubt, and named the trypanosome *Trypanosoma melophagium,* Flu 1908 (see this *Bulletin,* 1920, Vol. 7, No. 3, p. 135).

A few attempts were made by Hoare to confirm NÖLLER's work, but he did not succeed in cultivating trypanosomes from the blood of any of his four sheep, although they were infested with keds containing flagellates.

The authors who claim that the ked flagellates are transmitted hereditarily depict forms penetrating into the ova and thence into the developing embryo, but the forms described by the several authors would appear on examination to have nothing in common with each other. A number of ova and pupae were examined by Hoare, but he failed to find any forms which could be interpreted as stages of a flagellate organism, and the structures observed by PORTER were in all probability spermatozoa that had found their way into the ovaries. These authors, moreover, failed to find any traces of flagellates in the larvae or newly-hatched keds. It is only after prolonged feeding on sheep's blood that these organisms make their appearance in the gut of the young keds. It would, therefore, be natural to assume that the infection was obtained from the sheep's blood, but the above authors suppose that the organisms are present in what they term a cryptic stage in the larvae and newly-hatched keds, and become stimulated to final development by ingestion of the sheep's blood. Hoare made some attempts to infect mice artificially with the ked flagellates, and further extended his work so as to include experiments on artificial infection of different vertebrates with various insect flagellates. [A number of works upon this subject have been summarized recently in this *Bulletin,* notably those of LAVERAN and his collaborators and FANTHAM and PORTER.]

LAVERAN (1917), summarizing these researches, states that they firmly establish an affinity between Herpetomonas (and Crithidia) on the one hand and Leishmania on the other, an affinity which from the phylogenetic point of view is well recognised. FANTHAM even maintains they furnish proof that leishmaniases are arthropod-borne herpetomoniases, and that these maladies have evolved mainly from insect flagellates. Nevertheless, similar experiments repeated by other investigators produced negative results; thus CHATTON (1919) and NÖLLER (1920) repeated some of LAVERAN and FRANCHINI's (1919) experiments with the dog-flea flagellate, but failed to find any trace of infection. Similar experiments were made by WENYON (1914) with the same flagellate, also with negative results, and this author also failed to produce any infection in rats inoculated with the flagellates of *Tabanus socius*. The question with regard to the pathogenicity of flagellates from insects which are not naturally associated with any vertebrate is of still more complex character.

Hoare describes experiments in which flagellates from the water scorpion, bluebottle, and sheep ked were inoculated into mice, sticklebacks, newts, and frogs. In the case of the mouse experiments no trace of flagellate infection was found, either by repeated blood examination or by blood culture. The experiments with sticklebacks fed with the water-scorpion flagellates showed that these organisms were merely digested like any other food. Likewise no trace of infection could be seen after inoculating the fish with the flagellates. Experiments with frogs also proved negative.

In the course of these experiments it was found that the flagellates could resist the action of digestive juices and remain alive in the intestine of fish for five hours, and in some cases for 18 hours. When injected subcutaneously or intraperitoneally into fish, they might be found alive in the peritoneal fluid for four days. Contents of the gut of the sheep ked, diluted with normal saline, were kept at room temperature and at 30°C. In the portion that was placed at 30°C. the flagellates lived only one day, but those kept at room temperature lived seven days. No multiplication was observed, and the flagellates gradually lost their motility. The flagellates from the water scorpion could be kept alive for five days at room temperature in saline and in broth.

The author concludes that the facts available at present do not permit one to assert that the natural herpetomonads in insects, especially in those not associated with vertebrates, may become pathogenic when introduced into the latter animals.

BRUCE (E. A.). **Bovine Coccidiosis in British Columbia, with a Description of the Parasite,** *Eimeria canadensis* **Sp. n.**—*Jl. American Vet. Med. Assoc.* 1921. Mar. Vol. 58. (New Series. Vol. 11.) No. 6. pp. 638–662. With 3 plates comprising 53 figs.

In America bovine coccidiosis has hitherto only been described as occurring in the States of Washington, SCHULTZ (1915); New Jersey, SMITH and GRAYBILL (1917); Pennsylvania, LENTZ (1918); and New York, WAY and HAGAN (1920).

None of these authors, however, except SMITH and GRAYBILL, gave an account of the coccidium seen in their cases, but from the description given by these two authors it would appear that all cases of coccidiosis are not due to one type of organism (see this *Bulletin*, 1918, Vol. 6, No. 3, p. 141).

Four outbreaks of the disease are on record in British Columbia—three in the Kamloops district and one near Clinton. No connection could be traced between these outbreaks, which occurred in different years and approximately 20 to 60 miles apart. The cases appeared in winter, and the winter climate of the dry belt of British Columbia is by no means mild. At the time of the first outbreak the temperature was about 30° below zero, and 40° below zero during the fourth. No explanation could be offered as to why the disease should be more prevalent during the winter season. The author gives a short account of the course of each outbreak.

The first outbreak, which occurred in February, 1917, involved a herd of 430 head of cattle, two-thirds of which were under three years of age; at least 100 were affected, and 28 died. Only two definitely known to be over three years of age were affected, and one of these succumbed. This outbreak, it is stated, is of particular interest, as it was complicated by a mycosis, which not only affected the intestinal tract, but in some cases became generalised and showed the presence of hyphae in the spleen. The mycelium was septate, and tended to grow in the intestine in the form of clubs about 29μ long by 3μ broad at the wider end. This fungus was so abundant that it was not for some time after the trouble had abated that coccidia were found to be implicated, inasmuch as a rectal examination was not made. It would appear that the coccidia were the primary cause of the trouble, as attempts to set up the mycosis by feeding on suspected hay gave negative results.

The second outbreak occurred in January, 1918, in a herd of 1,500 head, but the disease was, however, confined to three corrals, containing 575 animals, and of these 500 were under one year of age. It is estimated that at least 40 animals were affected, and the first case was noticed on January 3rd, after the animals had been on their winter feeding-grounds for four weeks. At least two bulls nearly three years of age were affected, but most of those affected were calves about 10 months old. Eleven deaths occurred, four of which were in yearlings and the remainder in younger animals. Treatment was commenced on January 14th and proved most effective, and only one calf died after that date. The infected ground was ploughed and the disease subsequently did not recur.

The third outbreak occurred in March, 1919, in a herd of 108 head of cattle, 57 of which were under one year of age. Eight calves from four to six months old were affected, and five of these died.

The fourth outbreak was reported towards the end of January, 1920, in a herd of 160 cattle but the owner had previously lost two animals, in December. The disease, however, was confined to a lot of 50 animals all of which were over one year of age, with the exception of a seven-months-old calf, which had been kept separate from the main lot. Sixteen out of these 50 animals became visibly affected, and six died, viz., one yearling, two 2-year-olds, two 3-year-olds, and one cow. This outbreak was of interest inasmuch as the disease was confined, with one exception, to older animals. The calves were kept about half a mile away from the older cattle. Treatment as recommended in the second outbreak was instituted, and shortly after it was commenced one more case was seen, but no more deaths occurred and after two weeks' treatment the animals appeared healthy.

The symptoms described do not appear to present any noteworthy differences from those recorded in outbreaks elsewhere, viz., diarrhoea with the presence of blood clots in the faeces, and in chronic cases emaciation and anaemia, severe straining, sometimes grinding of the teeth; fever usually absent or very slight. A prominent feature in these cases was that with perhaps one exception fits were exhibited in all fatal cases just before death. Death occurred in from 8 to 24 hours after these fits were first seen and the animals then died in convulsions. Fatal cases usually died in from two to five days after the first symptoms were noticed. These fits, which might be attributed to cerebral anaemia, occurred at varying intervals. One cow was noticed to suffer from three fits while it was being driven a distance of 50 yards. It would seem that they were induced when the animal was disturbed; it appeared frightened, staggered, sometimes braced itself by resting its head on the ground with the forelegs widely spread, fell over, and frothed at the mouth. In a little more or less than a minute the animal got up and behaved as if nothing had happened. Only one animal was definitely known to have recovered after having shown one of these fits. Death sometimes occurred when the diarrhoea was abating.

The incubation period, that is, the period elapsing between infection and the first appearance of blood or oocysts in the faeces, was found out experimentally to be about 14 days.

Diagnosis essentially resolved itself into ascertaining the presence of the oocyst. One American author, however, has stated that the fertile encapsulated forms, that alone can infect pastures and cause disease in susceptible animals, are not formed in animals that perish, but in those that recover. This was not in accordance with Bruce's experience with cattle, as well as with rabbits and fowls, in British Columbia. A haemorrhagic diarrhoea usually following constipation, rapid emaciation, absence of high temperature, and convulsions, would suggest the disease, but a definite diagnosis is not possible without recourse to microscopic examination. In cases, where it was difficult to find the coccidia in the faeces the following method was used:—The faeces were diluted with an equal quantity of water, strained through a fine wire screen and then through several thicknesses of cheese cloth. If necessary this procedure was repeated a second time, the fluid obtained was then centrifuged for several minutes, excess poured off, and the residue examined. During the course of the work three different species of flagellates and an amoeba were seen. In one animal, a calf, two specimens of a Balantidium were noticed, measuring 126 by 89·5μ.

The post-mortem changes were similar to those described in other outbreaks, the most prominent lesions being in the rectum. The blood showed poikilocytosis and some polychromasia, but a polynuclear leucocytosis as reported by MAYER and CROCKER and by FANTHAM in birds was not seen. The leucocyte count in four affected cattle was as follows: total mononuclears 72·12, polynuclears 21·33, eosinophiles 6·41, mast cells 0·12. The parasite invariably destroyed its host cell completely but did not appear to have any deleterious effect upon neighbouring cells.

Treatment as recommended in various text-books could not be applied to an extensive outbreak or to range animals. It was therefore decided to try the following treatment:—Sulphate of iron 2 parts, sulphur 2 parts, salt 6 parts. Of this mixture 50 lb. was fed with 100 lbs. of linseed oil cake to 100 head of cattle per day. The mixture was placed in troughs to which the animals had free access. The results obtained are claimed to have been most gratifying. The treatment should be continued for two weeks. It is admitted that, owing to the tendency of the disease to spend itself many cases recovered spontaneously. However, there can be no doubt that if an animal can be helped over the acute stage its chance of recovery is enhanced.

Some of the oocysts in the faeces were kept under unsatisfactory conditions in the laboratory and found to be infective for 13 months.

FANTHAM has already shown that the oocysts of *Eimeria avium* are infective for two years after they have been passed. Sick animals should therefore be isolated, so that their faeces can be properly disposed of.

It is of interest that on one ranch the carcases of the dead cattle were fed to the pigs, which ate nearly everything but the bones, and therefore must have ingested a large number of oocysts. None of the pigs, however, showed any signs of disease. Horses, sheep and fowls kept on the same premises as infected cattle did not develop any symptoms, and guinea-pigs, rabbits, white rats and fowls were dosed with infective material, with negative results. The coccidium therefore appears to be specific for cattle, and experimentally it was proved that the disease could be transmitted to animals varying in age from one month old to one that was an aged cow. In the field animals ranging from four months old to one aged animal were found to suffer. The disease was most severe and death often resulted in younger animals. Three-year-old animals, however, were also found to succumb sometimes, and in one instance an aged cow died.

The author then describes some transmission experiments.

In view of the fact that this author describes under a new name the coccidium encountered in this disease, the description he gives of the parasite warrants careful notice.

Development of the Oocyst.

The oocyst varied in shape: spherical, elliptical and ovoid forms were seen, and rarely the ovoid cysts showed a slight flattening at the smaller end or were slightly concave. In adult animals about 45 per cent. were spherical, but in very young calves these forms were rare. The larger oocysts were always ovoid or elliptical. The smaller cysts apparently showed a tendency to become spherical in course of time, and in some faeces that had been kept for two years it was difficult to find other forms than spherical ones. All the cysts were circular on cross-section. The wall was double-contoured and varied in tint from colourless to a light mouldy brown. In the ovoid cyst the wall tended to diminish slightly in thickness towards the narrow pole. No evidence of a micropyle was seen. In the early stages of the disease the oocyst appeared to be larger, and in very young calves they were usually elliptical in shape. The measurements were (about 250 examined) from 11·6 to 43·1 μ in length, and from 11·6 to 27·8 μ in width. In animals over four months old (210 cysts examined) the measurements were, on an average, 17·4 by 15 μ, and cysts exceeding 20·7 by 17·6 μ were very scarce. In calves about six weeks of age it was not uncommon to find oocysts 33 by 24 μ.

The forms usually seen in fresh faeces were those in which the cytoplasm either completely filled the cyst, was beginning to contract, or had contracted into a circular mass. In the earlier stage the granules were finer than in the forms in which the cytoplasm had contracted. The granules were highly refractile, and occasionally they showed amoeboid movement. This phenomenon was observed to occur for over twenty minutes before the cell came to rest.

The nucleus was sometimes visible. The commonest form was that in which the cytoplasm had contracted into a circular mass, usually at the middle or towards the end of the cyst. It was composed of coarse, highly refractile granules, and the nucleus was sometimes visible in it.

In the next stage the granules separated, and the central mass divided up into four sporoblasts without a residual body, and each sporoblast secreted a homogeneous membrane, the sporocyst, in which it became enveloped. The contour of this membrane was in some cases bent at acute angles. The sporocysts became ellipsoidal in shape and circular on cross-section. At first they contained refractile granules, but then became homogeneous, and appeared to contain a number of vacuoles. Each sporocyst became pointed at one end, and a large vacuolated body appeared in the broad end, and the protoplasm then contained well-marked granules. The vacuolated body then moved towards the centre and divided; each half then moved towards the opposite pole.

The sporocyst now commenced to divide longitudinally to form the sporozoites. The single contoured membrane of the spore became thickened into a minute cap at the smaller pole (Stieda's plate), and two sporozoites were formed in the spore together with a residual body composed of refractile granules; this body usually lay between the sporozoites, but sometimes it was scattered; it was relatively larger in the smaller oocysts. The line separating the sporozoites tended to run diagonally across the spore, and this was more marked in the smaller cysts.

The sporozoites were broad at one end and tapered towards the other. The nucleus lay in or near the broad end, and the broad ends were placed at opposite poles of the spore; with their residual body the sporozoites completely filled the spore. The sporocysts varied in length from 6·6 to 19·9μ, and in breadth from 4·5 to 8·3μ.

It was shown that the sporozoites, under favourable conditions, were capable of rapid development, for one heifer showed evidence of infection after it had been dosed with faeces three days previously. On one occasion an oocyst was found to contain fully developed spores in faeces that were not more than 24 hours old, and had probably been passed less than 12 hours. Sporoblast formation was seen in faeces 24 hours old, but it was rare. When kept in the laboratory and supplied with moisture, complete development did not occur in less than eight days, and was delayed for weeks or months if too much or too little moisture was supplied. Some centrifuged faeces kept in a centrifuge tube, and supplied with a little moisture at very irregular intervals, showed after 13 months some oocysts that were still infective, some that had never developed, and a number that contained gas bubbles indicating degeneration.

Endogenous Development.

The description given of the development of the parasite in the tissues is of much interest, for there has been need for work upon this subject as it has been commonly taken for granted that the development of the cattle coccidium was probably identical with that of the rabbit parasite. The author illustrates his description with a number of good figures.

The sporozoites varied undoubtedly a great deal in size, but only two were seen in sections, and they measured approximately 10·7 by 2·4μ. They differed from the very similar merozoites in respect of their nucleus, which did not show a karyosome, was comparatively a little smaller, and was eccentrically located. Uninuclear schizonts were scarce in sections, and those seen measured 5·8 to 8·3μ by 4·9 to 7·4μ. They were rounded or elliptical in outline, their cytoplasm was alveolar, and the nucleus was usually eccentrically placed, relatively large, and contained a karyosome. The nucleus of the trophozoite then divided, and the number of nuclei produced then varied greatly in number. Forms containing as few as six were seen, up to those in which the number could not be counted. At first the nuclei were minute specks, but soon a clear area was seen around them, which gradually grew until it elongated to form the body of the future merozoite. At the same time the nucleus increased slightly in size, and, when the merozoites were well advanced, showed a well-marked karyosome. Schizonts were seen measuring from 8·3 by 8·3 to 61·4 by 49·8μ.

On one occasion a minute yellowish spot in the small intestine was placed under a cover slip and examined, and slight pressure was exerted upon it. This proved to be a schizont, the author states, containing merozoites that were evidently fully developed, as evidenced by a slow but distinct movement of their posterior end, and which were arranged into approximately 30 "bunches," each "bunch" being composed of merozoites, which radiated in all directions from a common centre with their posterior end (that is, the end further from the nucleus) towards the outside. This mass measured approximately 282 by 207μ. One or two other spots of apparently similar nature were seen in this intestine. [We suspect that this structure is identical with that first described in the small intestine of cattle by THEOBALD SMITH in 1893, and by MAROTEL, at Lyons, in 1907. The significance of these bodies is commented upon by RAILLIET (*Rec. Méd. Vét.*, 1919, Jan. 15, Feb. 15, Vol. 95, Nos. 1 & 3, p. 8), and he considers them to be analogous with the similar forms first encountered by MOUSSU and MAROTEL (1901-2) in the small intestine of sheep affected with coccidiosis. These bodies were subjected to a careful study by CHATTON (1910) and named by him *Gastrocystis gilruthi*; the structure was found also to be present in the abomasum of nearly all sheep and goats slaughtered at Paris, and its morphological details presented considerable affinities with the Sarcosporidia.—ED.] While in this unique schizont the merozoites were arranged in stellate form, in the schizont usually found they did not seem to follow any definite form, but resembled somewhat a lot of fish thrown into a basket. The schizont was circular or elliptical in outline, sometimes comparatively regular, and sometimes comparatively irregular. There was no cell membrane. The merozoites were about 10μ long by 2·9μ broad, but were subject to slight variation. Their cytoplasm was finely granular, and their nucleus contained a well-marked karyosome and was located towards the broader end.

Uninuclear microgametocytes were scarce in sections, elliptical in shape, 3·3 by 4·9μ, and their cytoplasm was not alveolar. Their nucleus was eccentrically placed and consisted of a karyosome surrounded by a halo which was sometimes not very distinct. The nucleus then broke up into minute granules and formed a fine chromidial network and, later, a number of minute spots, usually aggregated in masses, sometimes evenly distributed and at other times placed at the periphery. Minute loops were then formed, each of which gradually became more open and showed a slight thickening towards one end; the loop then disappeared and the microgametes became bow-shaped and showed a slight thickening towards their middle. These stained intensely with the basic aniline dyes and were arranged in the cell in three different ways, viz., around the periphery, in a well-marked band completely filling the cell, or in a reticular manner without any definite arrangement. When fully developed, the microgametocytes showed enormous variation in size—from 8·3 by 11·6μ up to forms so large as to fill the whole field of an oil immersion lens (116·2 by 132·8μ). The microgamete measured approximately 0·55 by 2·75μ. While it undoubtedly possessed flagella, these could not been seen.

The young microgametocyte could be distinguished from the uninuclear schizonts and microgametocytes by its rounder shape and its relatively large nucleus which was eccentrically placed and contained a karyosome. The smallest forms seen measured 3·3 by 3·3μ. At an early stage metachromatic granules were seen and the chromosomes became unravelled from the nuclear network (seen in a cell 8·3 by 6·6μ). The cell continued to grow and become loaded with chromatoid and plastinoid granules. The nucleus at this stage lost its rounded shape and contained a number of chromidial threads. The lighter staining plastinoid granules moved to the periphery and the chromatoid formed a more or less irregular circle around the nucleus. Owing to the deep staining of the chromatoid granules the nuclear changes were often obscured. The nucleus next showed a chromidial network surrounding the karyosome. Fertilisation took place, but this process was not actually observed. The nucleus then underwent several changes and became temporarily resolved into chromidia from which was formed, by concentration of the scattered granules, another complete nucleus. Shortly after fertilisation the cell began to show a thin membrane, apparently formed from the plastinoid granules. The wall appeared to form slowly. There was no evidence that the inner wall of the chitinoid membrane was formed by the chromatoid granules as pictured by FANTHAM in *Eimeria avium.*

The endogenous cycle of *Eimeria zurni* does not appear to have been worked out, and comparison of the coccidium described by BRUCE must therefore be based upon the characters of the oocyst. In ZUBLIN'S description of *E. zurni* no residual body is stated to be left behind in the formation of the sporoblasts and there is no residual body in the spore; in the British Columbia species a residual body occurs in the spore. SMITH and GRAYBILL described two varieties of oocysts in the coccidiosis of young calves in New Jersey viz., one small and corresponding to *E. zurni,* and the other larger and corresponding to Bruce's parasite, except that his coccidium showed a much greater variation in size. These authors, however, were unable to distinguish any difference in the endogenous cycle. Evidence of active multiplication in cattle older than three months was not noted by SMITH and GRAYBILL, and in their calves the seat of the disease was the large intestine. In British Columbia animals of all ages were affected, and while the large intestine suffered most in adult animals, in calves of three months or so the small intestine was most infected. Bruce believes that the coccidium here described differs from any previously described coccidium, and proposes to call it *Eimeria canadensis.*

BALOZET (L.). **Fréquence des formes latentes de piroplasmose bovine au Maroc.** [The Frequency of Latent Forms of Bovine Piroplasmosis in Morocco.]—*Bull. Soc. Path. Exot.* 1920. Nov. 10. Vol. 13. No. 9. pp. 733–734. With 2 figs.

Piroplasmosis is a very common disease among cattle in the well-irrigated districts situated at the foot of the Middle Atlas mountains in Morocco ; ticks are particularly numerous in the luxuriant vegetation of the district. The disease affects, on rare occasions, the cattle of the district in a mild form, but it is, on the other hand, common and often fatal among animals brought in from other districts, especially from the mountains. The breed of cattle that exhibited no disease symptom reveals piroplasms in about 40 per cent. of animals; the parasites are rare (one in every 5–10 fields), and are all rod, oval or ring-shaped or in the form of small points as described by VELU (1915) ; they thus resemble *Theileria parva, mutans,* or *annulata,* or the rod-shaped piroplasms described by SCHEIN in French Indo-China and in Algeria by SOULIÉ and ROIG.

In animals affected with acute piroplasmosis the author observed, associated with the preceding forms, the presence of bigeminate pear-shaped forms, which sometimes became very numerous, forming 20 per cent. of the total number of parasites. This association of the two forms of parasite in the acute type of disease has been recorded by SCHEIN in French Indo-China, and by others in Madras and Japan.

[It is difficult to identify exactly from the diagrams furnished by the author the type of piroplasm in the acute form of the disease. Some appear to be undoubtedly *P. bigeminum,* but at least one diagram recalls *P. divergens* (*bovis*), and it would appear that *P. bigeminum,* associated perhaps with *P. divergens,* is actually responsible for the morbid symptoms. The other piroplasms depicted in the blood of healthy cattle are undoubtedly *Gonderia* (*Theileria*) *mutans,* found widespread over the Continent of Africa.—ED.]

SERGENT (Edm.) & ESPÉRANDIEU (G.). **Études sur les piroplasmoses et les jaunisses en Algérie. VIII. A propos d'un accès suraigu de piroplasmose bovine à petites formes annulaires extrêmement nombreuses.** [Studies of the Piroplasmoses and Jaundices of Algeria. VIII. A Hyper-acute Attack of Bovine Piroplasmosis with Extremely Numerous Small Ring-Shaped Forms.]—*Bull. Soc. Path. Exot.* 1920. Dec. 8. Vol. 13. No. 10. pp. 779–783. With 2 text figs.

In this note the authors describe the case of a cross-bred native cow that had been affected with foot-and-mouth disease in May 1920 and became again severely affected with the disease in July. Local treatment was applied to the lesions and improvement seemed to have set in, but early in August the condition of the animal became again extremely serious. It showed depression, the horns were hot, the mucous membrane yellow and covered with petechiae. The buccal mucous membrane was extremely pale, the coat was rough ; the animal was first affected with constipation, followed by abundant diarrhoea, which was, however, seen in all the cattle affected with foot-and-mouth disease. The cow was killed, and on post-mortem examination the blood was jaundiced, the spleen was enlarged and the spleen pulp friable. A yellow jelly-like material filled the mediastinum, the bone marrow of the tibia was semi-fluid, and small haemorrhagic areas were strewn throughout it. The myocardium and the psoas muscles were macerated in appearance; the bladder contained a clear chocolate-coloured urine.

The peripheral blood examined at the time of slaughter showed an extraordinary number of parasites, and the majority of the corpuscles contained multiple parasites.

Out of 1,000 corpuscles 76 contained no parasite, 197 one parasite, 278 two parasites, 231 three parasites, 123 four, 55 five, 29 six, 9 seven, and 2 eight parasites; that is, 2,466 parasites in all. The size and shape of the invaded corpuscles were not changed. Scarcely one parasite in every 100 touched the margin of the corpuscle. Out of 2,000 parasites, about 1,700 were in the form of small round or oval rings, not pear-shaped and not exceeding 1μ in diameter, with an eccentric nucleus and a central vacuole. About 280 were in the form of short rods reaching up to 1μ in length, with a terminal nucleus which was always round and often contained a vacuole. About 20 forms resembled anaplasms.

With regard to the ring-shaped forms, a number (152) could be seen as very small chromatinic granules which could not be differentiated from anaplasms except by the presence of a thin blue ring attached to the red bezel. All grades of transition up to the largest rings, 1μ in diameter, with a round bezel, could be seen (505 forms). In numerous elements (944) the nucleus appeared stretched out, representing the first stage in binary division; this was seen in 92 forms and was of exactly the same type as that of Plasmodium in human blood, that is to say, it took the form of a ring broken through the bezel with a knob at each broken end. The nucleus was never centrally placed.

The rod-shaped forms likewise commenced as very small forms—a strand of cytoplasm attached to a chromatin granule. The nucleus always remained rounded, in the form of a granule, but the cytoplasm became elongated (140 elements), and then contained a vacuole (141 elements). In the vacuolated elements the cytoplasm became condensed at the opposite extremity of the nucleus. It was often only possible to distinguish the nucleus from this cytoplasmic granule by staining reactions.

Very rarely, atypical forms in the process of disintegration, with very sparse cytoplasm containing scattered chromatin granules, could be seen. The small anaplasma-like forms might be regarded as merozoites resulting from the fission of the ring-shaped forms with two nuclei. In the course of their development these anaplasms may give rise either to rings, or themselves develop until they undergo binary division, or, more rarely, to short rods, which perhaps also manage to give rise, in the course of a little slower development after the formation of a vacuole, to ring-shaped forms.

These parasites are reminiscent of *P. annulatum* of DSCHUNKOWSKY and LUHS, but *P. annulatum* is not a valid species, inasmuch as it comprises forms belonging to *Gonderia mutans* or to *Theileria parva* or even to forms of *P. bigeminum*. The name should therefore not be retained.

The following characters at once contra-indicate identity with *P. bigeminum* or *P. bovis*:—Complete absence of pear-shaped forms and of bigeminate forms; when two parasites are found contiguous it is obvious that their proximity is fortuitous; the diameter of the parasite is always very small and never exceeds 1μ.

Moreover, one cannot assign the parasite to the species *Gonderia mutans*, for rod-shaped forms are very rare, and none of them has a bacillary nucleus. There are no cross-shaped forms; the number of invaded corpuscles is enormous.

Likewise, the parasites cannot be assigned to *Theileria parva*, on account of their morphology, and especially on account of the symptomatology—blood-stained urine, jaundice.

The question arises as to whether they are merely very young forms of *P. bigeminum* or *P. bovis* which by very rapid binary division of the small forms lead to the death of the animal in a few hours, thus giving no time for the large forms to develop. This process would be comparable to that found in malignant malaria in man, for in this condition one sometimes sees during the pernicious attacks simply ring-shaped small forms, many of which are undergoing division.

The authors conclude that the condition described by them was in the nature of a pernicious attack due to very small ring-shaped forms of an undetermined species of piroplasm undergoing intense binary division and present to the extent of about 2·5 parasites per corpuscle.

VELU (H.). **La Piroplasmose bovine au Maroc et ses rapports avec les piroplasmoses circummediterranéennes.** [Bovine Piroplasmosis in Morocco and its Relationships with the Piroplasmosis of the Mediterranean Basin.]—*Bull. Soc. Path. Exot.* 1921. Feb. Vol. 14. No. 2. pp. 116–124.

The nature of the piroplasmosis found in cattle in countries bordering upon the Mediterranean Sea still remains a problem which requires much elucidation, and the symptoms manifested in the affections are often of a very divergent character. Velu therefore collates a number of observations made in Morocco during the last ten years, and compares them with those recorded by other authors.

The symptoms resemble those seen in East Coast fever and in the tropical piroplasmosis of the Transcaucasus region, as described by DSCHUNKOWSKY and LUHS in 1904. Clinically, Velu distinguishes three forms, viz., an acute, sub-acute, and chronic form.

In the acute form the period of incubation extends from 10 to 30 days, and the disease is first manifested by a sudden rise in temperature. Then for two or three days nothing is seen. Rumination stops, the appetite becomes capricious, the temperature remains high, the pulse and the respiration become accelerated, and the urine is almost always normal in appearance, and sometimes only has a reddish tint. The saliva flows away in stringy filaments, and there is an abundant serous discharge from the eyes. The pupils become swollen, and the superficial lymphatic glands enlarged. The visible mucous membranes are congested and show numerous petechiae. Not infrequently cerebral symptoms, muscular tremblings, and grinding of the teeth are seen, diarrhoea is common, and finally becomes blood-stained. Towards the last stage of the disease the animals lie down in a state of great depression. In four to six days the temperature falls, and the animal succumbs. The blood is not changed in appearance.

The sub-acute form is more common, and lasts from eight to ten days. The symptoms are similar, but do not develop so quickly and are not intense. The urine always remains clear. A yellowish, sometimes greenish, discoloration of the mucous membranes is more characteristic of this slowly developing form, which may sometimes last 15 to 20 days. If the animal survives the disease assumes a chronic form. The blood shows marked changes. It remains liquid and clots slowly. The serum is bile-coloured.

The chronic form is characterised by the temperature curve. The cachexia is ushered in by intermittent febrile attacks, lasting two to eight days, separated by afebrile periods. The condition ends in recovery, and the febrile attacks become gradually less and less marked. The symptoms are those usually associated with chronic piroplasmosis. The skin becomes thickened, "hide-bound," and the coat rough, the mucous membranes assume a jaundiced appearance, red-water is not seen, but the urine contains albumen and bile pigment. The animal wastes rapidly; the number of red corpuscles diminishes; sometimes the pulse becomes imperceptible; and, subcutaneous infiltration and oedematous swellings may be seen on various parts of the body, especially in the intermaxillary space.

The disease is particularly severe in imported animals. In Libya, CARPANO observed a case-rate of 100 per cent., and a death-rate of 90 per cent. in cattle imported from Serbia; these animals were particularly susceptible, and especially the young and female animals. Animals imported from Sardinia, Tunisia and Southern Italy appear to be less susceptible. Velu, in Morocco, made identical observations. As a general rule, imported cattle are particularly susceptible, and the first cases appear a month or two after disembarkment in Libya, Algeria and Morocco. These cases are always followed by several others, until nearly all the animals become affected; whilst native animals mingling with affected animals at the same time do not appear to suffer. In the majority of cases the disease passes unobserved in these animals, unless one takes the temperatures daily and makes blood examinations during the febrile periods. In Morocco the disease affects particularly young animals, and causes a high mortality. Recovery, if it takes place, is brought about very slowly, and convalescence always takes a long time. The disease appears generally in animals that have been travelled, although the fatigue involved in movement cannot be incriminated, for the first cases are sometimes observed after a considerable lapse of time—weeks or even months subsequently—and sometimes it appears after very short journeys. It is probable that there are local strains of parasites.

Lesions.—Post-mortem, one finds congestive lesions and small haemorrhagic points on the serous membranes, gelatinous infiltrations into the tissues, and blood-stained specks in the tissues. The lymphatic glands are enlarged and congested and infarcted on section, and a large quantity of liquid exudate flows from them. The spleen is enlarged in the acute and hyper-acute cases, but normal in the chronic cases. Neither the spleen pulp nor the lymphatic glands show multiplication forms of the piroplasms. The typical lesions of the disease are, however, according to CARPANO, the ulcerative lesions of the fourth stomach, which have been described by KOCH, and by DSCHUNKOWSKY and LUHS in the Transcaucasus. These lesions are also found in the colon and caecum. DUCLOUX, however, considered that they are due to *Linguatula serrata*, and Velu also maintains, from examinations made of them in Morocco, that they are not ascribable to piroplasmosis.

In the acute forms of the disease the blood is not altered macroscopically or microscopically. In the sub-acute forms the changes are very marked, the blood is more liquid, clots slowly, and the number of parasites in the red corpuscles is high. In the chronic forms the blood is watery and the number of red corpuscles may diminish to three millions per cubic millimetre. There is a leucocytosis affecting the mononuclears and polynuclears (CARPANO). The parasites are generally small in number; the number of corpuscles invaded has been reported to be 10 per cent. by MONTGOMERY, 30 per cent. by SERGENT and LHÉRITIER, and up to 55 per cent. by Velu and EYRAUD.

The different types of parasites encountered in the affected animals have been described by authors, but there is considerable lack of unanimity with regard to their nature. Morphologically, the parasites all present the characteristics of *Theileria annulata* and of *Theileria parva* or *mutans.* In the blood they assume the shape of very slender bacillary forms, with a mass of chromatin occupying about the middle of each rod, comma-shaped forms, with all the chromatin condensed at the larger extremity of the comma, ring-shaped, rounded and ovoid forms, or pear-shaped forms with the chromatin arranged in the horseshoe fashion at the larger extremity surrounding a clear central area. These forms differ from the characteristic pear-shaped elements of *P. bigeminum,* inasmuch as they are smaller—2-3μ in length at most—and they are not usually found in pairs. Amoeboid and dot-like forms are also seen. In the ring-shaped forms, as well as in the rod-shaped ones, the chromatin is surrounded by a protoplasmic zone.

According to KOCH the parasite closely resembles *T. parva,* and DUCLOUX maintained that the Tunisian parasite resembled *T. annulata.* LAVERAN stated that the parasite found by LESAGE and HELIOT did not resemble *P. bigeminum* or *T. parva.* SOULIÉ and ROIG claimed that the disease observed by them presented resemblances both to East Coast fever and the Transcaucasian disease, and the parasites to *T. mutans* and *annulata.* According to THEILER, who examined smears sent to him by PRICOLO (this *Bulletin* 1917, p 230) the parasites cannot be differentiated from those found in the blood of animals affected with East Coast fever, and, in particular, the presence of KOCH'S bodies left no doubt but that the parasite was in reality *T. parva.* According to CARPANO the disease would appear to be caused by to *T. parva* and *T. annulata,* and *T. annulata* would seem to be more nearly related to *T. mutans* morphologically and pathogenetically than to *T. parva.* The parasite would appear to reveal itself either as a rounded or ring-shaped form, oval form, pear-shaped form, or whip-shaped amoeboid, granular or anaplasma-like form.

BRUMPT maintains that although *T. mutans* may be identical in appearance with *T. parva* in the peripheral blood it can be easily distinguished from it by the absence of the characteristic developmental schizogonous bodies of the latter species, by its relatively feeble pathogenicity, and by the difficulty in transmitting it to healthy animals (see preceding number of this *Bulletin,* p. 1).

In certain cases piroplasms cannot be encountered in the blood. SERGENT (Ed.) LHÉRITIER and BOQUET have described a certain number of cases presenting a typical clinical picture of acute or hyperacute piroplasmosis with complete or almost complete absence of piroplasms in the peripheral blood or blood of the internal organs. A diagnosis of piroplasmosis might have appeared justified in such cases on clinical grounds and on account of the fact that other contagious diseases were eliminated by laboratory examination. However, it would appear, according to SERGENT, LHÉRITIER and PASTEUR VALLERY-RADOT, that the affection is a separate and distinct one, which they call "*la Fièvre bilieuse hémoglobinurique*" (haemoglobinuric biliary fever), and Velu claims to have encountered this condition several times in Morocco. The conditions which have to be differentiated from piroplasmosis are anthrax, haemorrhagic septicaemia, and rinderpest. Rinderpest may be easily confounded with the sub-acute form. Diagnosis may be made by microscopic examination of the circulating blood, and CARPANO recommends an exploratory puncture of the prescapular gland. Velu, however, did not on any occasion succeed in demonstrating KOCH's bodies in cattle affected with piroplasmosis in Morocco.

Attempts at experimental inoculation have been made by a number of authors. DUCLOUX inoculated an ox with the pear-shaped forms, with negative result. SOULIÉ and ROIG infected six native cattle, which subsequently reacted but did not die. A cow belonging to a French breed succumbed on the second day after the inoculation and presented all the lesions of piroplasmosis, but no parasites were seen on microscopic examination. According to CARPANO inoculation of blood of affected animals into healthy cattle sets up a sudden rise of temperature, due apparently to the reaction of a toxin. The inoculated animals present the symptoms of a single infection due to *T. annulata*, and the parasites persist for a long time in the blood after clinical recovery as they do in the natural disease. The resistance of animals belonging to certain regions tends to prove that the disease exists not only on the African side of the Mediterranean Sea, but also in Sicily, Sardinia, and Southern Italy. BRUMPT inoculated three calves successfully with the blood of adult Tunisian cattle, but they, however, did not present subsequently any clinical symptoms.

CARPANO claims to have succeeded in obtaining a culture of the piroplasms by adding 9 cc. of defibrinated infected blood to 1 cc. of sterile water containing 7 per cent. sodium chloride and 7 per cent. sodium citrate, and placing the mixture in an incubator at 25°C. After ten days anaplasma-like forms were seen, which then became flagellated and resembled the forms seen in infected ticks. These were regarded as the sexually differentiated elements.

Experiments made by BRUMPT to determine the transmitting agent gave negative results. CARPANO claims that the vector is *Hyalomma aegyptium*; cattle harbour only the adult tick, while the larva and nymph live on wild animals. BRUMPT is of the opinion that it is necessary to study ticks living at various stages in their development on cattle in order to find out the transmitting agent, and he believes that *Rhipicephalus bursa*, and to a less extent *Rhipicephalus sanguineus*, must be suspected.

With regard to prophylaxis, CARPANO made some attempts at immunisation, which did not, however, give any noteworthy results. Trypan blue appears to have no curative property. Arrhenal gave, according to PIOT BEY, interesting results. Sodium cacodylate, administered in large doses intravenously, gave in Velu's hands most encouraging results.

SERGENT (Ed.). **Étude morphologique du** *Piroplasma* (*Gonderia*) *mutans* **du Boeuf.** [A Morphological Study of *P.* (*G.*) *m.* of the Ox.]—*Ann. Inst. Pasteur.* 1921. Mar. Vol. 35. No. 3. pp. 193–203. With 1 coloured plate, comprising 18 figs.

The nature of the piroplasm first figured and described by THEILER under the above name, has been very differently conceived by various authors, and before undertaking experimental investigations, it appeared necessary to obtain some precise information with regard to the morphological types encountered and endeavour to determine the developmental stages. Over 1,000 small piroplasms were therefore drawn and measured, and the number of infested red corpuscles was at the same time noted. The blood was obtained from six Algerian cattle from fifteen months to three years old. Three of these animals were in apparent good health, and three suffered from various infections which had no apparent connection with the *mutans* infection. No other blood parasite besides the small piroplasms corresponding to the accepted definition of these organisms were encountered. The piroplasms could be classified in three large groups, viz. :—

(1) Rounded, oval, or elliptical elements which merged into dividing forms. A single large vacuole constantly present.

(2) Rod-shaped elements containing no vacuole, with a long nucleus occupying half the total length of the body. Binary division frequently seen.

(3) Rod-shaped elements possessing the characters of gametes.

The 1st Group. This group contains a number of differently shaped elements in various stages of development.

(1A) The smallest forms visible, which were less than 0·33μ in diameter, were rounded, or rather in the form of a ring composed half of chromatin (red), and half of cytoplasm (blue), surrounding a central vacuole. All ring-shaped forms less than 1μ in diameter are classed among these young forms.

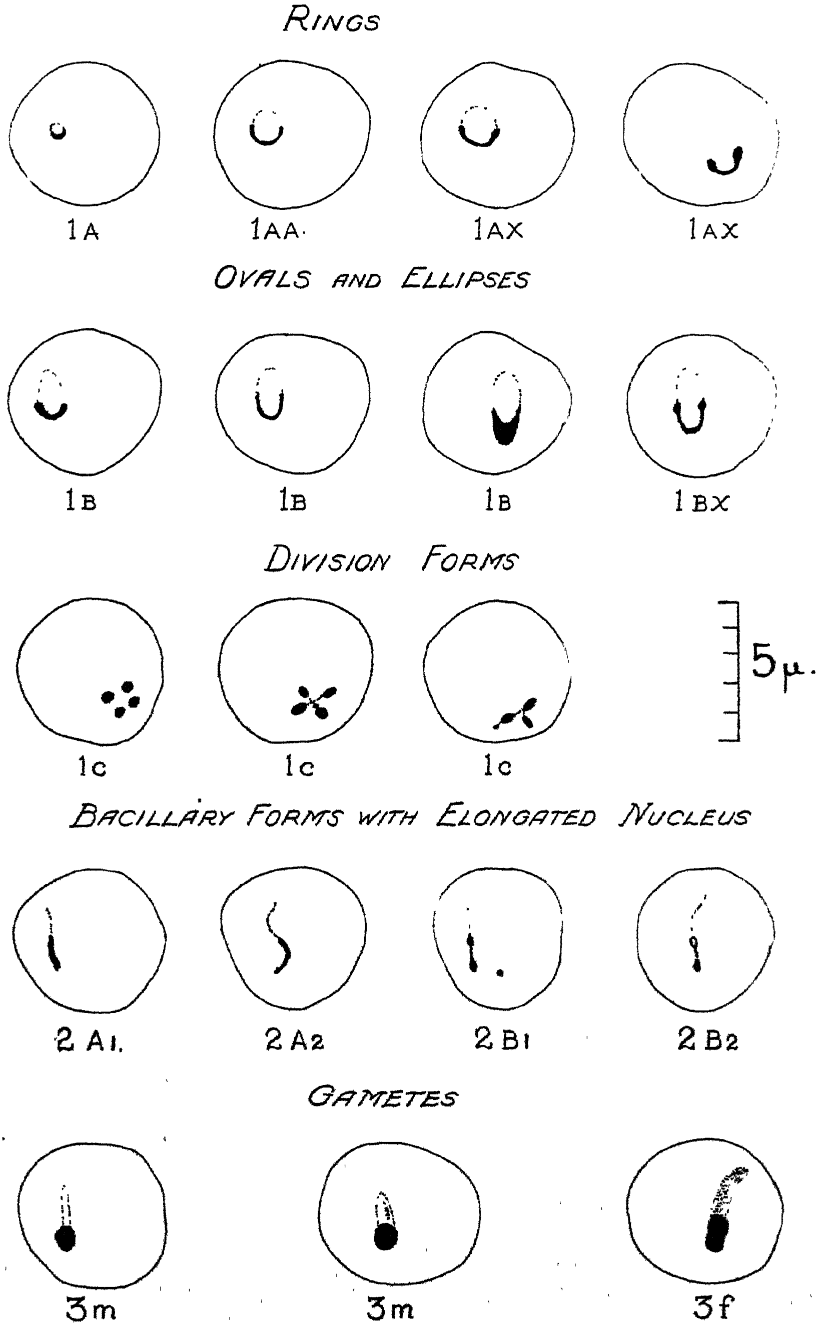
(1AA) The same ring-shaped forms are again found, of similar appearance, with increasing dimensions reaching up to 2μ in diameter, the average diameter being 1·6μ.

(1B) Besides ring-shaped elements, forms presenting the same structure, but which, instead of being circular in shape, are oval or elliptical in shape, are seen, the average dimensions being 2·4 by 0·8μ; maximum length, 3·5μ, minimum, 1μ; maximum breadth, 1μ, minimum 4μ. The nucleus and the cytoplasm, instead of forming two semicircles, describe two horse-shoe shaped figures which are contiguous at their extremities. In the elliptical forms, the chromatin describes sometimes a crescentic figure, instead of a horse-shoe shaped figure. One of these elliptical forms with crescentic nucleus was found in an extra-corpuscular situation. The cytoplasm of the oval forms was sometimes twisted like a blown flame and thus, apparently, it was capable of executing whip-like movements. The oval and elliptical forms correspond, perhaps, with ring-shaped forms disturbed by pressure or other special condition upsetting equilibrium.

(1AX) (1BX) The development of both the ring-shaped forms and of the oval or elliptical forms, leads up to the appearance of dividing forms. The semicircle or semiellipse of chromatin shows two, three, or four dot-like swellings, between which delicate chromatin threads persist for a long time.

(1C) Ultimately, groups of four (rarely three) chromatinic granules are seen, which stain a deep red colour and are arranged in the form of lozenges, each 1·5μ in average diagonal measurement; no trace of cytoplasm is seen, but the remains of the delicate loose chromatin is often seen stained a pale rose colour. These pale rose-coloured filaments join up sometimes the red granules in twos, and thus resemble two parallel dumb-bell-shaped structures. Sometimes all four are united together in this manner, so as to describe the borders

Forms of *Piroplasma* (*Gonderia*) *mutans*. [After Edm. Sergent.]



The solid black represents chromatin red, and the dotted portion the blue-staining cytoplasm.

of an irregular quadrilateral figure. The rose-coloured filaments are never arranged diagonally in the groups of four elements. The four granules are of an irregularly oval and angular shape. They are practically never all four situated in the same plane. Only on two occasions were cross-shaped structures seen (the limbs of the cross were stained blue, the extremities terminated in the red granules). In the first case, viz., the irregularly cross-shaped form, four large chromatin granules, plus a fifth small granule on one of the limbs of the cross were seen. In the second case, the blue threads described an L-shaped figure, with three chromatin granules occupying the extremities and the summit of the angle. A fourth small granule marked the middle of the smaller blue branch.

The 2nd Group. In the second group, the youngest elements are in the form of small chromatin rods less than 1μ in length. Bacillary forms, on an average 2·4μ long by 0·2 or 0·3μ broad, are especially in evidence. Maximum length, 4μ, minimum, 1·3μ; maximum breadth or width, 0·6μ, minimum, 0·4μ. Contrary to what has been described in the case of the majority of the bacillary forms hitherto seen, the nucleus is not rounded, but is elongated in the form of a linear rod occupying about half the length of the parasite, which hence has the appearance of a half-red, half-blue rod. In a third of the cases (190 out of 559 parasites), the long nucleus is marked at its extremities by two deeper red points, which causes the parasite to resemble somewhat a drum stick. These forms are figured in B1 and B2 (190 out of 1,369, or 13·88 per cent. of the total number of parasites, assumed this shape). Finally, about a third of the cases likewise (203 out of 559 times, the bacillary form with linear nucleus, whether this be compact or containing two granules), show whip-like movements—figs. A2 and B2 (203 parasites out of 1,369, or 14·83 per cent. of the total number of parasites assumed this shape).

The 3rd Group contains elements which seem to be derived from these bacillary forms, presenting ultimately the characters of gametes, being composed of microgametes (fig. 3M), with large alveolar or vacuolated nucleus and clear loose vacuolated cytoplasm. The smaller forms with rounded nucleus, which represents a form very frequently described by authors, were only quite seldom encountered in Sergent's observations, average dimensions, 2·3 by 0·5μ; maximum length, 2·8μ, minimum, 1μ; maximum breadth, 0·6μ, minimum, 0·3μ. Microgametes (fig. 3F), with a loose and not abundant nucleus and compact cytoplasm stained a deep blue, were seen, average dimensions, 2·5 by 0·9μ; maximum length, 3·3μ, minimum, 2μ; maximum breadth, 1·3μ, minimum, 0·3μ.

The same types of parasites as described above were encountered in all six oxen examined, but the relative proportion of the different types varied from one ox to another. For example, in two oxen the relative numbers of parasites falling into these three groups were, rounded forms 79·96 per cent., bacillary forms 9·3 per cent., and gametes 10·73 per cent. In four other cattle they were 24·93, 62·59 and 12·46 per cent. respectively. In the case kept under observation no information could be obtained connecting the predominance of a particular form at any given moment with the age of the animal, or the presence or absence of any morbid state, or the season of the year. Variations in the proportions of the parasites present had no relation to the temperature curve.

The author then endeavours to interpret the significance of the various forms observed.

The first group of rounded, oval, or elliptical parasites, he considers to represent the commonly found schizogonic forms of *P. mutans.*

The second group of rod-shaped elements with whip-like movements are young elements which are capable of showing binary division, analogous to that which is sometimes observed in the young Plasmodium in malaria, thus furnishing the parasites, in certain undetermined circumstances, with a second means of asexual reproduction.

The third group of rod-shaped elements leads up to the formation of gametes.

Anaplasmatic forms. Out of 229,800 red corpuscles examined, there were observed, besides the 1,369 small piroplasms, 15 structures, which would appear to correspond to the definition given to anaplasms as well as to that of Jolly bodies. The average diameter was 0·9μ, largest 1·3μ, smallest 0·25μ. Their presence in the animals did not coincide with any pathological or abnormal state. They much resembled the chromatin granules found in the quaternary groups described above. But there were certain differences in shape: the anaplasmatic form was well rounded, whilst the granule which resulted from the division of the chromatin was still, up to the time the group became scattered, angular and irregular.

Blood corpuscles. The degree of infection according to the above figures would come to 5·9 parasites per 1,000 red corpuscles. The maximum did not exceed 20 per 1,000 corpuscles. This proportion was observed in a heifer affected with purulent peritonitis, but infection was likewise seen in a heifer in very good health, which harboured 2 per 1,000 on an average over a period of a year, and at certain times, without any apparent reason, the proportion rose to 16 per 1,000, and then became re-established back to the original amount. Sometimes over 20,000 red corpuscles had to be examined before a parasite could be found. The most marked blood lesion was anisocytosis. Sometimes corpuscles undergoing punctate degeneration were observed. The infested corpuscles did not show any particular changes. Some were smaller, others were larger, than a corpuscle of average size. Average diameter 4·9μ, maximum 6·5μ, minimum 4μ. In 12 cases there was double invasion of the red corpuscle. On eight occasions the two parasites were one ring-shaped and one oval, while in four cases they were both rod-shaped. Microscopic examination of gland-juice taken during life, or after death, together with, in this last case, spleen pulp, never showed any Koch's bodies, which characterises invasion by *T. parva.*

DU TOIT (P. J.). **Experimentelle Studien über die Pferdepiroplasmose. III. Mitteilüng. Übertragungsversuche mit Zecken bei der** *Piroplasma caballi* **Infektion.** [Experimental Studies on Equine Piroplasmosis. 3rd Communication. Transmission Experiments with Ticks in Cases of *Piroplasma caballi* Infection.]—*Arch. f. Schiffs- u. Trop. Hyg.* 1919. Vol. 23. pp. 359–368. With 1 fig.*

The experiments were instituted in order to estimate the danger of *P. caballi* infection following upon its possible introduction into

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* Abstracted by Mr. S. C. J. Bennett, B.Sc., M.R.C.V.S.

Germany from the Balkan theatre of war. They follow previous work by the same author [see this *Bulletin*, 1919, Vol. 7, No. 3, p. 140], in which he demonstrated the small danger threatened by *Nuttallia equi* infection, owing to the non-transmissibility of this parasite by the tick most commonly found in Germany, viz., *Ixodes ricinus*.

The first series of experiments were conducted with *Ixodes ricinus*. Larvae hatched from the eggs of female adults which had been fed on a horse with *P. caballi* infection failed to transmit the piroplasms to a healthy horse. Further, the same ticks, fed on an infected horse as nymphs, failed to transmit the disease as adults.

It was unfortunately impossible to determine whether ticks infected as larvae could prove virulent as nymphs; the larvae took an extraordinarily long time to moult, and the author's enforced absence from Germany made it necessary to leave this question in abeyance.

The tick which served for the second series of experiments was *Dermacentor reticulatus*. Specimens of adult females had been sent from Macedonia, a district in which *D. reticulatus* is normally the carrier of *P. caballi* infection. As previous studies with this tick had not warranted unequivocal conclusions, confirmatory experiments were decided on.

In the first experiment, larvae were fed on a horse suffering from *P. caballi* infection. After moulting they were placed on a sound horse. This animal developed typical symptoms of piroplasmosis, with parasites in the blood at the end of ten days. The nymphs were collected and stored in order to ascertain whether they had "cleansed" themselves of the infection. With this object in view, the adults which developed from these nymphs were placed on a healthy horse. The ticks refused to attach themselves to their new host, the reason being, in the author's opinion, that it was the wrong season of the year. *Dermacentor reticulatus* is most active in the spring, and this experiment was attempted in the autumn.

Assuming this explanation to be correct, the ticks were stored through the winter and put on a healthy horse the following April (1919). Although only one female became gorged, the horse developed symptoms of piroplasmosis with parasites in the blood at the end of thirteen days.

The experiments with *Dermacentor reticulatus* are of considerable importance. In the first place, it is undoubtedly a transmitting tick in cases of *P. caballi* infection; moreover, the disease is transmitted by two successive developmental stages of the tick without any renewal of infection in between. It appears that this is the first recorded case of persistence of infectivity in a tick of the family *Ixodidae* during two successive stages. It is pointed out that ticks of this family may retain their infectivity over two stages, or even over the whole life-cycle, as in the case of *Haemaphysalis leachi*, which takes up *P. canis* infection as an adult, and is infective to susceptible hosts in the next adult stage. But, and particular attention is drawn to this point, no other case is known of a tick of this family being infective at two *successive* stages of the life-cycle.

The conclusions drawn from the above-mentioned experiments are that there is little danger to be feared in Germany from equine piroplasmosis, as the common indigenous tick, *Ixodus ricinus*, is a carrier of neither *Nuttallia equi* nor *Piroplasma caballi.* With regard to *Dermacentor reticulatus,* this tick is undoubtedly a transmitter of *P. caballi* infection, which it takes up in one stage and passes on at the next stage ; moreover, as shown above, there is a danger of its being infective even at the next stage as well.

DISEASES DUE TO METAZOAN PARASITES.

PATTON (W. S.). **Some Notes on the Arthropods of Medical and Veterinary Importance in Mesopotamia and on their Relation to Disease. Part 1. The Gad Flies of Mesopotamia.**—*Indian Jl. Med. Res.* 1920. April. Vol. 7. No. 4. pp. 735–750. With 1 plate comprising 2 figs., 5 text figs., and 1 map.

Whilst serving with the late Mesopotamia Expeditionary Force from November 1915 to August 1917, Patton (Director, Pasteur Institute of Southern India, Coonoor) collected a large amount of entomological material which he now describes in a series of articles. Dealing first with the Tabanidae or gad flies it might appear at first sight, he states, that the country, on account of its peculiar topography and climate, would be rich in species of this family. The riverine belts of vegetation, with their many creeks and watercourses, and the extensive marshy areas would seem to be ideal breeding grounds for these flies, but, nevertheless, only eight species, belonging to three genera, were found, and only two of these species were represented in large numbers. This fact might be explained away by the lack of sufficient cover and the scarcity of suitable animals to feed upon, and a point in support of this suggestion is that only two specimens of a dark species of Haematopota were taken, and it is well known that this species prefers usually a somewhat dense scrub which is certainly absent in Mesopotamia. The following were the important tabanids examined :—

Tabanus pulchellus Lw. (*T. cyprianus* Ric.). A small light-grey species with yellow legs and clear wings ; frontal stripe broad, with two small round calli ; abdomen with four somewhat indistinct spots, sometimes appearing as stripes on each segment. The species closely resembles the widely-distributed and oriental ethiopian *ditoeniatus* Macq., and it is probably only a local race of this fly. It has been recorded from Cyprus under the name *cyprianus,* from Seistan and from Persia, where it is said to be a common horse fly, and it also occurs in Algeria. It is widely distributed in Mesopotamia and it is, together with the next described species (*T. glaber*), one of the most important insect pests. It appears early in April in small numbers, and later in the season it is extremely common, only disappearing in September and early October. In the marshy areas along the Euphrates it swarms in great numbers and bites from early morning till dusk, and lays its eggs in enormous numbers on various objects such as wooden stakes. Mules and horses in a certain camp in these areas suffered severely from the effects of the bites of these flies and as a result became anaemic and thin. Various deterrents were tried, but with little success, and the only certain means of protection was housing the animals in reed huts. The females travelled long distances from their breeding grounds into the desert, and were caught on many occasions from five to six miles away. Were it not for a large species of bee-eater which fed on the flies, and the myriads of large dragon flies which also devoured them, it would have been impossible to have kept animals in the camp.

Tabanus glaber Bigot. A small dark-reddish species with black legs and clear wings. Frontal stripe somewhat narrow with three distinct calli; abdomen with a dark central stripe. Recorded from Afghanistan, Kashgar, Eastern Turkestan, Seistan, and Persia; widely distributed in Mesopotamia. It was very common during the end of the season from about August to November. Large numbers were caught on dromedaries in a camp in the neighbourhood of Nasiriyah, and these animals were at the time suffering from trypanosomiasis; all eventually died or had to be shot. The species was breeding along the banks of a creek in the vicinity of the camp. It does not appear to breed in marshy areas.

Tabanus polygonus Walker. A large reddish-brown species with light central triangular spots on the abdomen; wings clear; frontal stripe with a broad square callus at the base and a narrow black stripe extending, as a rule, from its upper border, but sometimes free. This species was first described from Baghdad, but it was found to be common all over the country. It could always be caught on horses and mules from March to September. It mainly breeds along the banks of creeks.

Tabanus pulverifer Walker. A rather small species with grey spots on the abdomen. Comes very near the European *Tabanus cordiger* Weidemann, but differs from it in some respects. Only one specimen of this species was taken in the marshy area along the Euphrates, not far from Kurnah. It is recorded from Baghdad and from Turkey in Asia.

Tabanus persis Ricardo. A small species, superficially resembling *T. pulchellus,* with yellow legs and clear wings without an appendix; abdomen greyish with light central and lateral stripes; frontal stripe broad with two well-marked broad calli. Recorded by RICARDO from Afghanistan, Seistan, and Persia, and is said to be common on horses and camels. In Mesopotamia it was almost always found in company with *pulchellus,* but never in large numbers. It breeds in the same places, and it seems probable that the small numbers as compared with those of *pulchellus* may be due to the larvae being outnumbered by those of that species.

Tabanus sufis Jennicke (*T. alboventralis* Newstead). A small blackish-grey species with yellowish legs and clear wings; frontal stripe very broad with divergent sides, with a large black basal callus and two round central ones placed side by side. Abdomen blackish-grey with a median dark line and diffuse spots. Recorded by SURCOUF from Jerusalem, Abyssinia, the Anglo-Egyptian Soudan, Mauretania (Morocco and Western Algeria), Senegal, and from Gambia by NEWSTEAD under the name *alboventralis.* Found in many parts of Mesopotamia, though not a common species. Breeds along the banks of creeks and along watercourses.

Chrysops punctifera Lw. A small greyish-yellow species with golden pubescence; antennae mostly dark brown. Thorax with two dark lateral bands. Abdomen yellowish, second segment with a V-shaped spot; legs yellowish, wings white, costal border brown, with one clear oval spot occupying almost the whole of the discal cell. This species was common at Basra along the creeks and watercourses during the months of April and May; it was also present along the Euphrates and Tigris.

Haematopota. Only two specimens of this genus, and these males, were taken during the whole time the author was in the country.

Gad flies, and the trypanosomiasis of dromedaries in Mesopotamia. During the late campaign more than 1,000 dromedaries belonging to the various camel corps in the country were lost as a result of a very fatal form of trypanosomiasis. The disease was widespread, occurring along the Karun, Euphrates and Tigris. The dromedary, as is well known, is one of the animals most highly valued by the arab, and particularly by the desert nomad whose very existence depends on it. There are two types, the riding variety, which is highly bred, of light build, and capable of great and continuous exertion, and the baggage variety, of heavy build, capable of carrying from 300 to 600 lbs. if properly loaded. The milk and flesh of these animals constitute the desert arab's food and the hair his warm clothing. The nomad arabs living in the desert areas bordering the rivers, particularly the Euphrates, breed these animals in large numbers, and many of the influential Sheiks own 1,000 or more head. It would seem that trypanosomiasis and its association with the bite of the gad fly is well known to these Sheiks, for in one instance at least the author found that although the animal mortality in a large herd amounted to 8 to 10 per cent. per annum, none of them died from trypanosomiasis. In this herd 1 per cent. of the dromedaries was over 9 years old, 5 per cent. were over 8, and the remainder under 6 years. The animals over 10 and up to 14 years were always killed and eaten. The owner brought his dromedaries to drink daily to a water hole a few miles beyond the head of a creek at dusk. The gad flies which formed a considerable belt along the water course had then stopped biting and the dromedaries were taken back to camp, which was well beyond the fly belt, immediately after they had been watered. In this way no animal was ever lost from trypanosomiasis. The dromedaries belonging to various camel corps, however, had to be kept well within this belt, and as a result they all became infected and died. Among them, however, were a few Sind dromedaries, and none of these appeared to become infected although some had been there during two fly seasons. This would suggest that they were immune to the Mesopotamian variety of trypanosome.

In one camp situated close to the Euphrates, just above Nasiriyah, a number of animals recently purchased from an Arab Sheik were collected in July to October, and very soon they began to sicken and show large number of trypanosomes in their blood. *T. glaber* was found in large numbers feeding on the dromedaries, and, except for a few specimens of *T. pulchellus*, it was the only species seen. There were no other biting flies, but there were large numbers of a new species of haematophagous *Musca.* These conditions seemed to be ideal for studying trypanosome transmission. A large number of specimens of *T. glaber* were collected, and it was found that 100 per cent. were infected with a species of Crithidia closely resembling *C. tabani* Patton. A large percentage contained the characteristic post-flagellate stages massed in the hind gut, and the contents of the rectum contained large numbers of flagellates. No true trypanosomes were found in the flies and there were no parasites in the salivary glands, indicating that the trypanosome did not undergo any developmental changes in the flies.

From previous studies on the Crithidia parasitic in gad flies, the author had found that they were acquired by the adult flies in the act of sucking blood. It was, therefore, only necessary on this occasion to watch these flies feeding to see that this was probably the only way by which they became infected. *T. glaber*, as well as most gad flies that attack dromedaries, bite them on the belly, chiefly in the neighbourhood of the genital organs, udder and sheath, and inside the thighs. As the flies feed they eject a dark fluid, sometimes pure blood, from their alimentary tracts on to the skin and hair of the animal, where it can be seen as sticky drops. This fluid on examination proved to contain large numbers of flagellates, and the post-flagellate stage referred to above was seen. Before sucking blood the flies searched for a suitable spot and applied their labella to the hair and then to the skin, and in this way ingested the Crithidia. The dromedaries were noticed to drive away the flies by licking the sites bitten, and at each such act they would infect their lips with the various stages of the parasite. It therefore seemed that the trypanosome in the blood of the dromedaries might be nothing else than a stage of these Crithidia parasitic in the fly, and that when this parasite came into contact with the mucous membranes of the mouth, it penetrated into the blood and there assumed the trypanosome stage. It has been repeatedly demonstrated by many authors that Herpetomonas and Crithidia can find their way into the blood by way of the alimentary tract, and it is known that trypanosomes can penetrate the mucous membranes.

There appears to be sufficient evidence also to show that two of the commonest non-pathogenic trypanosomes of domesticated animals are stages in the life-cycle of flagellates which are also represented in other stages as Crithidia in the alimentary tract of tabanid flies [see also p. 69 of this number. Nöller claims to have proved that the non-pathogenic trypansome (*T. theileri*) of German cattle is represented during a stage in its development as a flagellate in the gad fly, *Tabanus glaucopis* Meig. (this *Bulletin*, 1917, p. 15), and later he demonstrated that the sheep trypanosome, *T. ovis*, assumed a crithidial form in the gut of the sheep-ked *Melophagus ovinus* L. (this *Bulletin*, 1919, p. 135).—Ed.]

The author attempted to carry out an experiment to substantiate this hypothesis under very imperfect field service conditions. Two young dromedaries known to be free from trypanosomes were isolated for two months in a camp known to be free from flies on the left bank of the Euphrates at Nasiriyah, and at the end of this time they were still free from trypanosomes. A large number of specimens of *T. glaber* were collected from the camp mentioned above and dissected, and the various stages of the Crithidia, obtained only from the hind guts, were placed on the buccal mucous membranes of these animals. Unfortunately the experiment could not be carried to a conclusion. [In order to ascertain the infectivity of these crithidial forms it seems strange that the author did not attempt transmission in the first place by subcutaneous inoculation before attempting the more difficult mode, viz., by the intact mucous membranes.—Ed.]

The author then gives an interesting summary of the literature dealing with trypanosomiasis of dromedaries in other parts of the world, and our own present knowledge of the method of transmission of the causative agents. The large mass of evidence seems to point to gad flies as the vectors, but the mode of spread by the flies is by no means clear. Our present knowledge appears to be that gad flies only act as mechanical carriers, and that the trypanosomes soon disappear from their alimentary tracts, and that only those parasites that chance to be on the labella and prestomum are carried to healthy animals. If this is the case, then, the author maintains with reason that it is difficult to understand why the gad fly is the only certain carrier, when it is known that many other species of biting flies are just as intermittent in their feeding habits, for example, the many species of Stomoxys and the haematophagous species of the genus Musca, which are always present in the company of biting flies all over the world. It should be noted also that all feeding and transmission experiments with gad flies have been carried out with wild specimens, and not with flies bred in the laboratory. [The author omits one important reference concerning the transmission of trypanosomiasis by tabanids, viz., that of MITZMAIN, who carried out investigations on surra transmission in horses and other animals in the Philippine Islands, and seemed to have proved beyond doubt that *Tabanus striatus* Fabr. acted as a mechanical carrier, and that *Stomoxys calcitrans* particularly and other biting flies do not act as vectors (this *Bulletin*, 1918, Vol. 6, No. 4, p. 224).—ED.]

The author suggests certain definite lines of investigation, but, unfortunately, in the case of gad flies, this would be met with difficulty owing to the fact that there is considerable trouble in rearing the early stages to maturity, as most of their larvae are predaceous. They are not easily found in nature in sufficiently large numbers, but they can be bred out by keeping each larva in a separate receptacle.

Control of gad flies in Mesopotamia. The dromedary owners in Mesopotamia avoid the fly areas and are well acquainted with the belts along the rivers where the gad flies abound, particularly in the summer months. Their animals are kept outside these belts, and they are only brought into them to be watered at dusk, and are always driven away before the flies appear in the morning. If forced to graze their animals in the infected areas, they do so only in the early morning and late evening, when only stray specimens of the flies are on the wing. As the breeding grounds of the flies cover enormous areas of country, it would be quite impossible to attempt to destroy the early stages. Much might be done, however, to destroy the eggs by introducing into the country certain species of Chalcids which are parasitic on the eggs of the flies. It is also well to remember that the tabanid-infested areas represent a source of danger for horses.

The author kindly offers to give interested persons further advice regarding the gad flies of Mesopotamia, and to identify any specimens sent to him.

PATTON (W. S.). **Some Notes on the Arthropods of Medical and Veterinary Importance in Mesopotamia, and on their Relation to Disease. Part II., Mesopotamian House Flies and their Allies.**—*Indian Jl. Med. Res.* 1920. April. Vol. 7. No. 4. pp. 751–777. With 4 plates and 6 text figs.

"Mesopotamia, in addition to being renowned as the birthplace of the human race, also enjoys the unenviable reputation of being the home of the house fly." The extraordinary rapidity with which flies appeared in myriads in camps is familiar to those who went through the recent campaign. In this paper Patton describes the various species of house flies and their allies which are of economic importance, and sets forth in some detail the best measures for controlling these insects.

(*a*) *Musca determinata* Walker. A typical member of the genus, with four black thoracic stripes and closely resembling the European species *Musca domestica,* but differing from it in some small but definite details. This species was first described by WALKER in 1856 from the West Indies, and has since been recorded from various localities in India and is probably widely distributed, being common throughout Mesopotamia, Aden, Egypt, and probably Palestine. The egg of this species is exactly similar to that of the common house fly, and is 1–25th of an inch long. The full-grown larva is creamy white, and ½ inch long. The eggs are laid in batches of 150–250 or more, and oviposition is complete after two to four such batches have been laid. During the summer months, in Mesopotamia, the eggs hatch out in from six to eight hours, the larval stage lasts 36 to 42 hours, and the adults emerge 36 hours after pupation. Under such conditions, and with a rich food supply, one generation succeeds another in from 72 to 90 hours. In the cold weather all the stages are retarded.

As the result of a long series of feeding experiments carried out in the field, Patton found that the following larval foodstuffs were selected by the adult female for oviposition in their respective order of predilection : (1) Human excrement, and the green partly-digested food from the stomachs and intestines of cattle and sheep ; (2) horse and mule droppings ; (3) decaying vegetables, tea leaves and other kitchen refuse ; (4) cow dung, which was utilised only to a small extent, and apparently in the cold weather only, when it was collected in large heaps. The larvae pass down into the food mass and remain hidden from view, but during the night come up to the surface, and when they have eaten through a mass of horse dung it presents a characteristic appearance. The heap, which is probably irregular at the surface, becomes flattened out and presents a worm-eaten appearance, due to the larvae having passed through it over and over again. This is a point of practical importance, as it enables an observer to detect a breeding ground with certainty. The mature larvae, after a short resting period, migrate, usually at night, and crawl away to select a suitable nidus in which to pupate. Sometimes, however, they pass down into the earth directly below the mass, provided it is moist and there are cracks into which they can insert themselves. The extraordinary power the larvae have of burrowing into the earth, even when hard, is remarkable. The adults, on hatching, nearly always collect together in the vicinity of the breeding grounds, when copulation takes place, and they then scatter to their feeding grounds. This is considered to be another point of practical importance, for if one finds a small swarm of house flies collected together in any locality, and more particularly if they fly on to any moving objects and settle in a clump, they are almost certainly recently hatched flies, and the breeding ground will be found near by.

(*b*) *Musca humilis* Weid. A widely-distributed species, probably even more so than the type species of the genus (*Musca domestica*). It is a small to medium-sized greyish species, with two black thoracic bands and a chequered abdomen. Found along the Northern African coast ; a common bazaar fly in Egypt and the Soudan, in Port Said, Aden, and the Aden Hinterland, and in many parts of India ; occurs throughout Mesopotamia and probably in Palestine ; also found in many parts of China and in Australia. It forms a connecting link between the house fly group and the haematophagous species. It may be seen on horses and cattle, feeding on sores and cuts and on the blood which exudes from the bites of true biting flies. It was described by THOMPSON from China under the name *angustifron,* and the author also found it to be identical with the specimens described under the names *Musca euteniata* Bigot, and *M. conducens* Walker; probably also with *M. precox* Walker. The egg and larva of this species are so similar to those of the previously described one that it can hardly be differentiated, but there are some few technical points of difference. The eggs are laid in somewhat smaller batches, otherwise their life-histories are very much the same. The larvae are capable of developing into maturity in many foodstuffs, and may be found in cow dung dropped in the field, in heaps of horse manure, in human excrement, and in the green partially-digested food of the alimentary tracts of sheep and cattle.

In Mesopotamia, house flies are responsible for an appalling amount of ophthalmia among the human population.

There are many weak points in the life-history of the house fly. It is a gregarious insect, lays its eggs together in masses in foodstuffs suitable for its larvae, and the latter, on hatching out, keep together and later migrate from the breeding ground in order to pupate. They can only reach maturity when the temperature, moisture and fermentation conditions are at their optimum, and an increase of one of these factors reacts on the other and upsets the balance.

The author then describes how, after studying the life-histories of the two house and camp flies in Mesopotamia, the prevention of breeding and the destruction of flies was accomplished at Nasiryah—observations which later led to the successful control of these insects throughout the occupied parts of the country. The methods depended largely on the burning of all human excreta, of equine droppings, and especially of the contents of the viscera of slaughtered animals. The precautions to be observed in working the incinerators, preferably covered, are described. In hot weather the horse manure is first spread out on dry ground in order to dry it in a uniform layer, about four inches deep, turned once or twice, and immediately burned in the incinerators. In the cold weather this could not be accomplished owing to the heavy dews, and the biological method of dealing with manure, in which it is used to breed and at the same time to destroy the house fly larvae, was adopted. This method has been employed especially by ROUBAUD. Large quantities of fresh manure were heaped into mounds varying from 20 to 25 feet in height and 30 to 40 feet in circumference, with flat tops. Each mound was placed on a selected piece of hard ground, and consisted of a two-days' collection of fresh manure. On the third day the manure from the centre of mound No. 1 was removed and the fresh manure of the day buried in the hole, and covered with the hot manure. This was done in the case of each of the other mounds. By the time the last mound was thus utilised No. 1 and part of several others had been removed and burnt in the incinerators, and fresh mounds started. In this way the fresh manure was each day exposed to the heat and gases in the mounds, and all eggs and larvae were destroyed. It was soon found, however, that the above two species of flies began to breed on the layer of manure on the outer surfaces of the mounds, but they could not penetrate for more than four or five inches on account of the great heat. A small shallow trench, six inches wide by four inches deep, with straight steep sides, was therefore constructed to encircle each mound, and it was found that the larvae, on trying to leave the mound, fell into the trench and had to pupate in it, as they could not scale the sides. A thin layer of dry manure was spread along the bottom in order to encourage them to remain in the trench. Each morning, manure containing the larvae and pupae was swept up with small brooms and buried in the hole of a hot fermenting mound. The results of these experiments induce the author to recommend thoroughly the so-called bio-thermic method for dealing with large quantities of horse manure, particularly in tropical countries.

In order to destroy larvae in semi-liquid material, such as the partially-digested food from the viscera of slaughtered animals, it was found only necessary to dig a trench six feet deep by four feet wide by 10 feet or more long and leave it for a night. Next morning it always contained from two to four feet of water, depending on the locality, and the larvae and pupae were readily drowned.

Methods are then described for dealing with the adult insects, and these comprise the use of kerosene oil torches for burning the flies on the inside of the walls of buildings, erection of roofs under which the flies would collect and could then be burned at dusk, and the use of properly constructed and baited traps. The green partially-digested food material from the stomachs and intestines of recently slaughtered cattle, was found to be most attractive bait.

A new species of haematophagous fly, *Musca mesopotamiensis,* is briefly described. This is a comparatively large species superficially resembling *Musca pattoni*, but readily distinguished from it by the width of the front in both sexes. The egg of this fly is also very similar to that of *M. domestica,* but is much larger and is characterised by the absence of a spine. The mature larva is creamy white in colour and measures $\frac{5}{8}$ths inch. The eggs of this species, some 30 in number, are always laid singly in patches of cow dung dropped in the field. The larvae, when ready to pupate, migrate from the patch and bury themselves very deeply in the ground some distance from, or sometimes below, the patch of dung. Puparia collected during the end of October and in November, and kept in some earth did not hatch out until the following March. The flies disappear in November and only reappear during the early days of March. No larvae could be found in patches of cow dung during the cold weather, but on the other hand it was possible to find puparia in the ground near the old patches. The species, therefore, hibernates during the winter in the pupal stage. As mentioned in the preceding extract, large numbers of this species were seen on camels feeding on the exudation of sores, eyes, etc., coming from the bites of the true biting flies. Both sexes may be seen on cattle, horses, mules, and donkeys, flying from one animal to another and worrying biting flies to try to induce them to withdraw their probosces before becoming replete with blood. In this way it is considered that the species may be the vector of disease-producing organisms. The flies were never seen in tents, houses, or bazaars.

Two more muscid species are mentioned, viz. (1) *Musca tempestiva* Fallen, a small, dark grey species, with four black thoracic bands. Widely distributed in Europe, common in Mesopotamia, and can always be seen in the summer months on horses and cattle following biting flies and behaving like *M. mesopotamiensis.* Its early stages are not known, but as it was often seen sitting on patches of cow dung, it is very probable that it breeds in this substance ; (2) *M. vitri* Meigen, a small metallic species, probably not belonging to Musca but to Claxemyia. The eyes in the male are hairy; widely distributed in Europe and Africa, and common throughout Mesopotamia, and, like the preceding species, seen on horses and cattle following biting flies and sucking up any blood exuding from the bites. Its early stages are not known, but it probably breeds in patches of cow dung. It is very probable that these two species occur in Northern India.

Only one species of the genus Philaematomyia, viz., *P. crassirostris* Stein (*insignis* Austen), was seen, and it was very plentiful on cattle all over the country. This fly is of a greyish-yellow colour with light thoracic stripes, especially in the female, while the thorax in the male is much darker and the stripes are better marked. The female eyes are widely separated, and the species can be distinguished also from a Musca by examining the proboscis, for the mentum is well marked, while in Musca it is feebly developed.

Only one species of the genus Stomoxys, viz., *S. calcitrans*, was met with in Mesopotamia, and this fly can be easily recognised while it is biting horses and cattle by noting that it keeps its wings well apart, and the long proboscis cannot be missed. This fly was a great pest at Nasiriyah during the flood season.

Lyperosia exigua, a slate grey to dark grey, large species, is widely distributed throughout Asia, India and Mesopotamia; commonly seen sitting on the shoulders of cattle with its head directed downwards. *L. minuta*, a small, dark grey species, is found throughout India and many parts of Africa, and is very common in Mesopotamia.

Blow-flies.—*Calliphora erythrocephala* Macq., the well-known European bluebottle, or blow-fly, was very common during the summer months, laying its eggs in meat, dead bodies of animals, offal and other animal refuse.

Chrysomyia (*Pycnosoma*) *albiceps* Weid., a medium-sized bright metallic-green species, is common all over the country, and breeds in the same situations as the last-named fly.

Lucilia sericata Meigen, the well-known sheep blow-fly, a medium-sized bright metallic-green species and very widely distributed; of great economic importance on account of its habit of laying eggs in the soiled wool of sheep, and thus causing considerable loss to farmers. Was never observed to do this in Mesopotamia; this was probably due to the fact that it had much other animal matter always available in which to lay its eggs. Many specimens of larvae were collected from wet mud contaminated with the urine of horses, and the typical adults were bred out of these. It could not be bred in the bodies of dead birds or small animals. The blow-flies, it is stated, can be readily controlled in the places where they breed. All dead bodies of animals should be burnt, and the same should be done with meat offal, etc.

Flesh flies (Sarcophagidae). These can always be recognised by their grey colour and often reddish eyes, striped thorax, and chequered or spotted abdomen. Two important genera are found in Mesopotamia, viz., Sarcophaga and Wohlfahrtia.

Sarcophaga haemorrhoidalis Fallen, was very common during the height of the hot weather, when dromedaries affected with trypanosomiasis were dying in large numbers. Owing to the lack of fuel the bodies of these animals had to be buried, and as this was a difficult task the fly found in them an excellent breeding ground for its larvae. Females deposit their larvae in the bodies long before decomposition sets in. *Wohlfahrtia meigenii* Scheiner, a large grey Sarcophaga-like fly, with characteristic round spots on the abdomen, was very common all over Mesopotamia, and deposits its larvae in the dead bodies of animals. Other species of this genus have been recorded as attacking man and animals and depositing their larvae in sores, and even in the eye, but no cases of myiasis caused by the larvae of this species were seen.

PATTON (W. S.). **Some Notes on the Arthropods of Medical and Veterinary Importance in Mesopotamia, and on their Relation to Disease. Part III. The Bot Flies of Mesopotamia.**—*Indian Jl. Med. Res.* 1920. July. Vol. 8. No. 1. pp. 1–16. With 2 plates comprising 4 figs.

THE HORSE BOTS.

Gastrophilus intestinalis var. *bengalensis* Macq.—This is a large tawny-yellow species resembling the common European horse bot (*Gastrophilus intestinalis*) in appearance, but of a lighter colour and smaller in size. The morphology is described in detail; the egg of this species is in every respect similar to those of *intestinalis*, and they are laid, one at a time on a hair and in a great variety of situations—high on the shoulders, on the neck, on the sides of the abdomen, on the insides of the hocks, and even on the mane. The female fly, however, seems to prefer the hairs on the inner side of the forelegs to any other site, and here they may be found in large numbers, and as many as 20 eggs may be found attached to a single hair. The larvae, like those of *intestinalis*, normally live in the stomach, and, to a small extent, in the duodenum of the horse and mule.

The method by which the larva of *intestinalis* reaches these organs has been investigated lately by several authors. ROUBAUD has shown that the young larvae of *intestinalis* can burrow into the buccal mucosa of a guinea-pig and pass down parallel to the surface as far as the throat [see this *Bulletin*, 1918, p. 13]; the larvae would, therefore, seem to reach the stomach by penetrating the mucous membrane of the lips, to which they get attached when the horse licks egg-laden hairs. HADWEN and CAMERON [see this *Bulletin*, 1919, p. 21] showed that the larvae were unable to penetrate the skin of the horse. When in Mesopotamia, Patton obtained a number of *bengalensis* larvae by passing a moistened finger along egg-laden hairs, and these were placed on his skin in order to see whether they could penetrate it. After crawling about for more than one hour and making feeble attempts to attach their hooks to the skin, the larvae seemed to make no progress. Under normal conditions, therefore, they do not penetrate the skin of their host, even although they are able to hatch out from eggs without either the aid of friction or moisture, and there seems little doubt that they gain access to the alimentary tract by way of the mouth. It is not yet definitely settled whether they pass down the tract by their own exertions, are swallowed with food, or whether they penetrate the mucous membrane of the mouth, and then make their way to the neighbourhood of the stomach, to reach the interior of the cavity later. Patton believes that many are swallowed accidentally with food, and that some may produce the so-called "creeping myiasis" as they pass along in the tissues to the stomach. In Mesopotamia the adult insects are seen in March and April, and again in August and September; they are very common during these months, and may be seen laying their eggs on horses and mules during the hottest part of the day. The larval stage is passed inside the horse during the winter months, from about the end of October and the beginning of November until March, and again from April to about the middle of August. As is well known, the adults do not feed, as their mouth parts are atrophied.

Gastrophilus nasalis L.—A medium-sized dark species, thickly covered with rufous and light hairs. The eggs of this species, unlike those of *bengalensis*, are laid on the hair close to the skin, and they are deposited one at a time on the hairs between the rami of the jaws. It was noted that when *nasalis* was ovipositing, the animal kept jerking its head up as if to drive away the momentary attack of the fly. This movement was so characteristic, that when one horse among many others was behaving in this way, it was certain that a specimen of *nasalis* was ovipositing on the hairs between its jaws. On closer observation it was noted that the fly approached the horse by darting between its legs and under the abdomen, and appeared to strike it between the jaws. An egg was always found after each time a fly was observed behaving in this way. It is extremely difficult to catch the fly, as its movements are so rapid that one only sees a dark object passing up the abdomen to the jaws to disappear as rapidly. The eggs do not appear to be inserted into the skin. The eggs of *intestinalis*, as is well known, require friction in order to enable the larvae to spring off the opercula, and this is always available when a horse licks egg-laden hairs. With *nasalis*, however, this never happens owing to the peculiar situation in which eggs are laid, and the larvae must reach the alimentary tract by their own exertions. HADWEN and CAMERON found that 51 per cent. of the eggs hatched without any artificial aid, and at the time the larvae were hatching out, they noticed numerous small scabby areas in the intra-maxillary region of horses, and the authors suggest that these areas were produced as a result of the larvae burrowing under the skin. In this connection it is interesting to note that CARPENTER and others have conclusively proved that the larvae of the cattle warble flies only reach the tissues of their host by penetrating the skin immediately adjacent to the egg. The adults of *nasalis* are seen at the same time as those of *bengalensis*, but not nearly in such large numbers. There are apparently two broods during the year.

The presence of *bengalensis*, as also happens with *intestinalis*, may cause a horse to become restive, and in some cases may lead to a stampede, especially with timid animals, and those unaccustomed to the flies, although, as a rule, the animal is not more irritated than by the bites of Stomoxys or tabanids. The presence of the throat bot (*G. nasalis*) is always resented, and this seems to be due to its method of attack. One female *nasalis* will annoy an animal far more than a dozen *bengalensis*, and the cumulative effect of a number of these flies leads to irritation, worry, loss of flesh, and mechanical injuries due to rubbing or falls. It is interesting to note in connection with the recent descriptions in the literature with regard to the probable connection between bots and infectious anaemia of horses, that Patton did not see or hear of a case of this disease in Mesopotamia.

With regard to control, good grooming and cleanliness obviously are the most beneficial means. It is not anticipated that the various repellents that can be used are of any value. Care should be taken to clip away all egg-laden hairs. If this is done thoroughly and carefully every afternoon during the fly season, the chances of infection will be reduced to a minimum. Further, all mature larvae should be collected and dropped into the incinerator and destroyed. The heavily infested Arab horses should not be allowed near horse and mule lines. In the case of *nasalis*, however, it may be advisable to use some mechanical protection, and a very good one has been described by HADWEN and CAMERON. A piece of canvas is attached to the posterior margin of the nose-band, and posteriorly to the rings of the neck-strap, so that it fits closely over the lower jaws, protects the intramaxillary space, and completely prevents the fly from ovipositing.

CAMEL AND DROMEDARY BOTS.

Cephalopsis titillator Clark (*Cephalomyia maculata* Weid.). A rather small dumpy fly with a mahogany-coloured thorax and a silvery abdomen marked with black spots and streaks. This fly is larviparous in habit and not oviparous as is generally supposed, the larvae being deposited just inside the nasal orifices. The female fly, when about to larviposit, hovers over the nose of the dromedary and then darts at the nasal orifices, depositing one or more larvae at a time. The young larvae apparently crawl up the nostrils by their own exertions to the nasopharynx, where they remain until they are mature. Patton examined the nasopharynx of many dead dromedaries, and the moment the larvae were exposed, they detached themselves and made violent attempts to escape. The mature larva measures about 32–34 mm., is markedly cylindrical in form, and is strongly convex dorsally. Each segment, except the last three, is armed with six large cone-shaped spines on its dorsal surface, three lateral spines, and four on the ventral surface.

The fly is extremely common in Mesopotamia and there are two broods during the year. The larvae of the early brood begin to leave the nasal cavities of the dromedary about the middle of March and continue to do so for three weeks. Larvae collected by the author on March 22nd 1917, pupated on the 23rd to the 27th, and flies began to hatch out on April 10th. The flies were seen depositing their larvae about the middle of April and continued to do so for about a month. These larvae began to leave the nasal cavities about the middle of August and the flies reappeared early in September. These flies again began to deposit their larvae about the middle of September.

It was quite common to see 40 to 50 flies, both males and females, around a dromedary. The movements of the female when she is about to larviposit, sets up considerable irritation and causes the dromedary to sneeze and snort violently. The presence of the flies, however, in no way disturbs the animal.

The mature larvae always left the nasopharynx and began to crawl down the nostrils when the animals were having their evening meal about 5 p.m. The dromedaries fed in long lines on both sides of an earthen trough in which the food was placed. Every now and then an animal would be seen to get restless, stop feeding, and start sneezing and snorting. A more violent sneeze always meant that a larva had been ejected, and it was only necessary to get up to the animal and examine the trough to find it. Many of the larvae were seen crawling out of the nostrils and dropping to the ground. Large numbers of larvae and puparia could be collected from the earth and crevices in the trough wall in dromedary lines during the season.

AUSTEN states that the specimens of this fly taken from the camel have more infuscated wings than those of the dromedary species.

THE SHEEP BOT.

Oestrus ovis L. A medium-sized dark-grey oestrid with white and dark reflections on the abdomen. Very little is known regarding the life history of this fly and there is considerable doubt as to whether the species is oviparous or larviparous, although it is found wherever there are sheep in all parts of the world. Patton expresses no doubt but that in India and Mesopotamia the fly is larviparous, and he has always been able to recover the larva by dissecting the female fly. It would, therefore, appear that the larvae are deposited just inside the nose when the female fly hovers over and strikes at the nostrils. A full description is given of the larval stages, and the mature larva. The fly appears to have two broods in Mesopotamia corresponding with those of the dromedary bot. It is very probable, however, that the fly goes through its life-history much more rapidly in the hot weather, because it is quite common to find fully developed larvae and immature ones at the same time in the nasal passages of the sheep. This was not seen during the winter months. Owing to the protective coloration of the fly it is difficult to find it, yet judging from the large number of larvae seen in the nasal passages of sheep it must be extremely common, for not a single sheep was found to be free from them.

The larva of the dromedary bot does not appear to interfere in any way with the health of the animal, but an examination of the nasopharynx of a large number of dromedaries, however, showed that the larvae set up considerable inflammatory changes, especially when they were present in large numbers. It would be quite easy to devise some mechanical contrivance which could be placed over the nostrils to prevent larvipositing, and collect and destroy the larvae. This would materially lessen the number of flies.

The sheep bot causes, as is well known elsewhere, a purulent discharge from the nostrils; later the sheep may fall and roll on the ground, with clenched jaws, rigid neck, eyes prominent, and death may follow. In the majority of infected sheep, however, a copious nasal discharge is the only sympton resulting from the presence of the larvae. In a country like Mesopotamia where sheep are raised in large numbers, one would think that many of the animals would succumb to the heavy infection, but this is not the case. The Arab takes no precautions to prevent his animals becoming infected and no means can be suggested for controlling the pest.

SOWERBY (M. H.). **Cutaneous Oestriasis in the Dog.**—*Vet. Jl.* 1921. April. Vol. 77. No. 4. pp. 143–144.

In this short note the author describes the case of a dog that was admitted into the hospital of the Bombay Veterinary College suffering from a wound on its scrotum. Seven days after admission a swelling appeared on another part of the scrotum, and in about a week an abscess formed and two or three dead larvae were found in the evacuated pus. At irregular intervals four more like abscesses formed, three on the inside of the right thigh and one on the abdomen. The larvae were about 15 mm. long, composed of 12 segments, and were probably larvae of *Dermatobia cyaniventris.*

GUPTA (M. C.). **Internal Parasites in Elephants.**—*Vet. Jl.* 1921. Jan. Vol. 77. No. 1. pp. 25–28.

In India, diseases due to internal parasites are about the most important among elephants, causing sometimes sudden death of the animals with the presence of an enormous number of worms in the bowels. All elephants are found to harbour a few parasites and a moderate invasion causes no appreciable loss of condition. The first prominent symptom due to the presence of large numbers of one or more species of worms is earth-hunger. The animal eats large quantities of mud, which causes rather violent purging; the dejecta are generally watery and dark-coloured and contain large quantities of worms. The invasion becomes pronounced in animals suffering from some other debilitating disease. When the case becomes subacute in character, signs of digestive disorders of an ill-defined nature become apparent and anaemia becomes very prominent. Debility and emaciation become progressively more marked in chronic cases, the skin becomes dry and broken in parts, and oedematous swelling of the extremities occurs in advanced cases. Constipation followed by diarrhoea sets in and the faeces are occasionally tinged with blood. The mucous membranes are pale, the eyes are dull and present a peculiar look which, to an experienced observer, signifies a worm infestation. In severe cases the condition becomes rapidly worse and the appetite is entirely suppressed. Straining becomes more severe, the faeces become quite fluid and very foetid. The gait becomes staggering, the pulse and temperature are increased at times, the eyes are deeply sunken, and finally the animal can no longer stand up and dies from exhaustion. Sometimes convulsions and paroxysms of colic are manifested. The author gives a rough sketch of the various common parasites found in the elephant.

(1) *Bots.* The bot fly, which is about the size of a bee, and of a dark-greyish colour, is generally most active during the hot season, from the sunny days of June to the beginning of October. As in horses, it deposits its eggs on the fore parts of the body and the ingested eggs hatch in the pharynx, oesophagus, stomach and intestine; mortality due to these parasites is stated to be not uncommon.

(2) *Round worms.* The most common are (*a*) *Ascaris lonchoptera*, together with other Ascarids. The body of *A. lonchoptera* is pinkish-white, head usually slightly curved, and provided with two lateral membranous wings which are broader behind than in front. The part usually infested is the small intestine. (*b*) Hook worms (Uncinaria, Ankylostomes) comprising (i) *Dochmius sangeri* Cobbold and *Uncinaria os papiliatum* Ostertag; (ii) *Bathmostomum sangeri*. These are very common in both Indian and Burmese elephants. Round worm infestation is very prevalent during wet seasons and on low-lying and swampy lands.

(3) *Flat worms* (*Fasciolidae*) comprising both Amphistomes and liver flukes. In 135 post-mortem examinations made by the author, seven elephants were found to be suffering from both these forms of parasites.

Prophylaxis consists in avoiding wet, marshy and suspicious pastures, and segregation of sick animals, together with access to good clean water, and, if possible, to running water. A liberal allowance of salt in the diet is recommended. Santonin and areca nut are claimed to be the most effectual parasiticides. The mixture recommended is powdered areca nut 1 oz., santonin crystals and calomel, of each, 2 drachms. This dose should be repeated in five days. Preparatory to giving the first dose, the elephant is tied up at night and administered 8 oz. Epsom salts at 6 p.m. At 10 o'clock the vermifuge is given, and early next morning a second dose of Epsom salts is given, the animal in the meantime being kept off food. If the animal shows marked wasting in condition, it should be put on a nourishing diet before treatment; otherwise care has to be taken not to use irritant drugs, and calomel alone is recommended in doses of 120th of a grain per lb. body weight. The average weight of an elephant is 6,048 lb. Tonics such as arsenic, iron, nux vomica, and gentian are given during convalescence. Thymol, oil of chenopodium, and turpentine, did not prove successful anthelmintics in elephant practice.

FOLEY (H.). **Microfilaires du chien dans le sud-oranais** (*Mf. immitis*; *Mf. auquieri*, **nov. sp.**). [Microfilariae in the Dog in the South Oran District of Algeria.]—*Ann. Inst. Pasteur.* 1921. Mar. Vol. 35. No. 3. pp. 212–217. With 1 coloured plate.

While investigating dromedary trypanosomiasis (debab) in the above district, the author observed in the blood of dogs used for experimental purposes the presence of two microfilariae, viz.: (1) *Mf. immitis*, and (2) a hitherto undescribed species. According to NEUMANN (1914), five species of microfilariae can be encountered in dogs' blood, viz., the embryos of the following filariae: (1) *Dirofilaria immitis* Leidy; (2) *D. repens* Railliet and Henry; (3) *D. ochmanni* Füll.; (4) *Acanthocheilonema reconditum* Grassi; and (5) *A. dracunculoides* Cobb. Ochmann's microfilaria furnishes the only sheathed microfilaria of the dog.

(1) *Mf. immitis*. This widespread microfilaria appeared to be of common occurrence in the South Oran District dogs (it was found in 27 out of 96 dogs from which blood preparations were examined), and it is probably much more common than this proportion (22 per cent.) would indicate. The dogs were native dogs, commonly called kabyles, or crosses of this breed with various imported European breeds, and they lived constantly in the open. None of the infected dogs showed any symptoms attributable to filariasis.

When examined in the fresh state the parasite exhibited twisting and entangling local movements, but only slowly escaped from the field of the microscope. Striation was moderately visible; no sheath, tail markedly attenuated, and movements still fairly active after 48 hours when examined under a cover glass edged with vaseline.

The cephalic extremity bore a probe-shaped process which appeared at first sight to possess most energetic propelling movements. In fact, however, the process is formed of a pointed, slightly arched strip, which is raised like a valve by a sharp trigger-like movement. It is only lowered or shut for brief intervals. In stained smears the organism is usually seen twisted on itself, sometimes turned in spiral fashion and rarely stretched out straight along its whole length. The head is rounded and very slightly attenuated at its extremity. The cuticular striation is scarcely visible at the thin non-nucleated caudal extremity. When stained with weak Giemsa (1 in 40) the nuclei are loosely arranged, oval or rounded, and assume a deep reddish-violet colour. The clear spots are disposed as follows:—

(1) Cephalic area of slightly variable length, ill-defined posteriorly on account of the loose arrangement of the anterior nuclei, the lateral

nuclei being situated at an irregular distance and often in front of the middle ones.

(2) Oblique spot, which is always very clear and occupies almost the whole breadth of the embryo.

(3) V-shaped spot, which usually occupies only a portion of the breadth, and no structural detail is visible in it.

(4) Caudal spot, which appears to be almost as constant as the preceding ones and, in the form of an oval, clear area, occupies two-thirds of the breadth of the body. Beyond this spot the nuclei become arranged almost immediately in the form of a single column; the tail ends in a very fine tapering point deprived of nuclei.

The "central body" does not usually stain with Giemsa, but on rare occasions it is seen in the form of a coarsely granular pinkish-violet thread, slightly swollen at both extremities. In the neighbourhood of this structure the nuclei are scattered apart considerably, and thus the zone corresponding to the central body is made quite visible after staining. As is the rule, the dimensions were variable, depending not only upon the thickness and the more or less rapid desiccation of the smears, the mode of fixation, etc., but also upon the host of the microfilariae examined. In the case of six well-prepared specimens seen in smears fixed in absolute alcohol and stained by haematein or Giemsa, the dimensions were: Total length, 175–253μ; maximum breadth or width, 5–6μ; length of cephalic spot, 7–10μ; distance of cephalic extremity from (*a*) oblique spot, 33–51μ, (*b*) from V-shaped spot, 52–71μ, (*c*) from caudal spot, 141–190μ, (*d*) from central body, 81–96μ; length of clear space corresponding to central body, 24–34μ; length of non-nucleated caudal portion, 14–21μ.

The periodicity of the parasite was studied in the case of a markedly infected dog, but the phenomenon did not appear to be distinct. The organisms varied considerably in number day by day, and they were rare or numerous to an equal degree in smears taken during the day or during the night. Attempts at discovering the adult filariae in the cardiac cavities and large vessels of a dog, the blood of which revealed numerous microfilariae, proved fruitless.

(2) *Mf. auquieri,* n. sp. This organism was found in four dogs out of 63 examined, and in one of these cases it accompanied *Mf. immitis*. When examined in the fresh state it appeared to be a very short organism endowed with only slight local movements, and but rarely and very slowly leaving the field of the microscope; sheathless; striation but slightly visible and seen more particularly on the margins. The anterior extremity was rounded and scarcely tapering, and a slightly serrated circular collar or flange could be distinguished in it, forming a sort of prepuce, which, during its movements of retraction, slightly disclosed the rounded extremity of the head. In the centre of the head could be seen a double papilla, without stilette. After staining with weak Giemsa the organism appeared stumpy, sheathless, rigid in appearance, and usually assumed a stretched out straight appearance with a single curve towards its middle or towards its end, and it showed but rarely along its length one or two folds. The fine striation of the cuticle could only be seen on the margins; the nuclei were compacted and irregular, and occupied the whole length and thickness of the body, and stained an ultramarine blue. The nuclei at the extremity often assumed a reddish tint. The last nucleus did not

quite reach the caudal extremity, which tapered suddenly in a short and very acute point.

The clear spots were disposed as follows:—(*a*) Cephalic area was very short; the foremost nuclei, which were often disposed in longitudinal columns, nearly reaching the extremity of the head; (*b*) oblique spot, constantly present, quite distinct, with parallel borders, and occupying the whole width of the body; (*c*) caudal spot, often absent and always rather indistinct. After staining with Giemsa no central body could be seen, In eight specimens stained with Giemsa the dimensions were: Total length, 58–102μ; maximum width, 6–8μ; length of cephalic spot (in two), 2·5–3μ; distance of cephalic extremity from (*a*) oblique spot, 13·5–22μ, (*b*) caudal spot (in two), 44–78μ; length of non-nucleated caudal extremity (in five), 6–8μ.

This microfilaria appears to be undoubtedly a new species. *Dirofilaria repens* is even larger than *Mf. immitis*, varying, according to RAILLIET and HENRY, from 300–360μ by 6·5–8μ. *Mf. recondita* measures, according to NOE, 216μ by 4·3μ. The embryos of *A. dracunculoides* measure 195–230μ by 5–5·5μ. Ochmann's microfilaria measures, according to FULLEBORN, 320μ, and is sheathed.

Mf. auquieri did not appear to exhibit any distinct periodicity, but perhaps the periodicity of these microfilariæ might have been disturbed by the habits of the native dogs, which sleep at irregular times. During part of the day they are in sleeping condition, and as they are good watchdogs they bark furiously around the tents for many hours during the night.

TURKHUD (D. A.). **Dracontiasis in Animals, with Notes on a Case of Guinea-Worm in a Cobra.**—*Indian Jl. Med. Res.* 1920. April. Vol. 7. No. 4. pp. 727–734. With 2 plates (1 coloured) comprising 3 figs.

Guinea-worm disease has been recorded by a number of investigators in dogs, horses and cattle, and in this article the author first gives an account of the rare cases that have been recorded in India. That the condition is a rare one is evidenced by the fact that during the course of investigations conducted in the Bombay Bacteriological Laboratory, the Director and Staff of the Laboratory visited a number of villages in the Bombay Presidency in which guinea-worm disease was known to be widely prevalent among human beings, but in these excursions they came across no cases showing the presence of the worm in any of the village animals, such as cats, dogs, goats, horses and cattle, although these animals always drank the same water as the inhabitants of the infected villages. The villagers themselves had no knowledge of infection in these animals with guinea-worm.

Dogs. SMYTTAN (1825) and FORBES (1837) recorded the presence of guinea-worm disease in dogs in India, and more recently GAIGER (1910) reported five cases of *Filaria medinensis* in dogs. Two of these were discovered at the Punjab Veterinary College, and the other three at the Veterinary Hospital, Simla, and in all cases, it was stated, the worms were identical with the human parasite, and contained a white fluid in which were the coiled-up embryos. There is also in the Museum of the Madras Veterinary College a specimen of guinea-worm closely resembling the human guinea-worm removed from a dog. In 1917 experiments were conducted at the Parel Laboratory, Bombay, with a view to producing guinea-worm disease in dogs by feeding them on infected Cyclops, but the experiments proved unsuccessful.

Horses. FORBES (1838) described a case of guinea-worm infection in a country-bred pony at Dharwar in the Bombay Presidency. The worm protruded from a swelling near the right hind fetlock, and, according to this observer, it was examined before and after extraction, and no difference between it and the human Dracunculus could be perceived. CLARKSON (1845) found a guinea-worm in an Australian waler at Kotagherry, on the Nilgiri Hills. COBBOLD (1881) reported infection of a pony at Secunderabad. BATLIWALA (1893) again described infection of an Arab gelding in Burma, and the worm was stated to be very much like the guinea-worm, which is very common in man in Katywar. In 1914 Turkhud received a specimen of guinea-worm extracted by BHAVE from a pony at Thana, in the Bombay Presidency.

Cattle. BLANCHARD (1890) stated that the disease was known in 15th century Arabic medicine to occur among cattle. There are no records showing the existence of the infection among Indian cattle. On the authority of HECKENROTH, it is asserted by BARTET (1909) that the disease is met with among cattle in West Africa.

Wild Animals. The records are very scanty, but a few cases have been described in some of the wild animals of Africa. According to RAILLIET (1889) guinea-worm was recorded by PIOT in a jackal killed in Upper Egypt, and also in an Egyptian wolf. VALENCIENNES (1856) found a number of coiled up guinea-worms in the subcutaneous connective tissues of a hunting leopard from Kordofan, and CAZALBOU (1909) came across similar worms in a monkey. LEIPER (1910) recorded an interesting case of guinea-worm infection in a leopard shot in North-Western Rhodesia, a part of Africa where guinea-worm disease is not known. The worm, which was 45 cm. long and 1·5 mm. broad, was stated to resemble exactly the guinea-worm found in human beings on the West Coast of Africa, and its body was filled with a single uterine tube crowded with embryos corresponding exactly in size and structure with those of the human worm. BROOKE-FOX (E.) (1913) describes what is apparently the only observation of guinea-worm infection among the wild animals of India living in the natural state. The parasite was found in a Chinkara buck shot at Junagadh in Kathiawar. About half a dozen thread-like semi-translucent worms, varying in length from two to five inches, and all alive and vigorous, escaped from the bullet wounds in the skin.

The author refers to two additional cases of the occurrence of the worm in wild animals in captivity: (1) a leopard sent to the Bombay Bacteriological Laboratory from the Victoria Gardens for post-mortem examination about 12 years ago; and (2) from an abscess on the thigh of an Arabian baboon received in 1919 from the Gardens. The worm was entire, 92 cm. long and 1·5 mm. in diameter, and resembled the human guinea-worm in every respect.

Guinea-worm in the Cobra. The case described by the author is unique, as this is the first account of the occurrence of the worm in a cold-blooded animal. The snake had been purchased by the Laboratory for venom production, and seven months after purchase a loop of worm about 1 mm. thick and 4 cm. long was noticed to be protruding from a slight swelling on the head. This piece was found to show a central uterine tube containing active embryos somewhat smaller than but otherwise resembling those of the human guinea-worm.

The cobra was subsequently killed. A small quantity of whitish fluid was found to exude from the opening in the swelling, and it contained a large number of embryos, which were sluggish at first, but soon became quite active, and swam about in water like the embryos of a human guinea-worm. The guinea-worm was found to be situated between the muscles on the back parallel to and along the right side of the spine. The anterior extremity was missing, and when about 12 cm. of the worm had been dissected out it was found to terminate in a short curved tail. It was 1 mm. in breadth, but in all other respects resembled the human guinea-worm. The embryos were much smaller than those of the human guinea-worm; length 0·3 mm., breadth at broadest part 15–20 μ.

Some of the embryos were added to water containing Cyclops, while a few were allowed to remain in plain water at room temperature. The latter, however, were all found dead after three days. Examination of the Cyclops 12 hours afterwards showed that 10 out of 12 became infected. In five days 15 out of 42 examined were infected. In a fortnight's time 150 infected Cyclops were withdrawn. The embryos measured at this time 0·6 mm. long by 30 μ broad. The Cyclops were divided into six lots of 25 each, and six healthy cobras were fed each with a lot of 25. Three healthy cobras were similarly fed out on 25 Cyclops infected with embryos of the human guinea-worm. All these cobras died within the subsequent 12 months, but only two showed any abnormal post-mortem appearances, viz.: (1) Died 2½ months after feeding. A worm about 2 cm. long and 1 mm. broad was found subcutaneously just under the abdominal scales, midway between the head and the anal aperture. The worm was flat, transversely striated, and showed contractile and relaxing movements. This cobra had been fed with Cyclops that received the embryos of the cobra guinea-worm. (2) Died ten months after feeding. Five worms were found within it, all flat, transversely striated, and also showed alternate relaxing and contractile movements. Four of the worms were small, about 2 cm. in length, and situated in the peritoneal cavity. One worm was situated just underneath the skin. This cobra had been fed upon Cyclops infected with embryos from a human guinea-worm.

As so little is known about the development of *Dracunculus medinensis* within the body of its definitive host, it could not be stated with certainty that these represented undeveloped forms of a guinea-worm.

BACTERIAL DISEASES.

DODD (S.). **The Etiology of Black Disease.**—*Jl. Comp. Path. & Therap.* 1921. Mar. 31. Vol. 34. No. 1. pp. 1–26. With 6 figs.

A reference to this author's previous interesting studies on this disease have already been made in this *Bulletin* [1918, Vol. 6, No. 3, p. 190], and although the disease under consideration is not of particular importance from the point of view of tropical work, but is, on the other hand, a common and serious condition in temperate countries, the investigations threw considerable light on certain aspects of ovine pathology. The author had already proved that the organisms incriminated by former workers as the causal agents of braxy-like diseases could be attributed entirely to post-mortem or agonal invasion, for when, after diligent search, subjects were obtained while they were still showing symptoms and a bacteriological examination was made of their tissues and body fluids, the findings were almost invariably negative.

In this paper Dodd describes the post-mortem changes observable in sheep slaughtered when they were found to be ailing or when examined just immediately after death. The early lesions of the disease were definitely traced to the liver, but all the livers, moreover, showed evidence of recent fluke invasion. The organ almost invariably showed one or more necrotic foci, greyish or dirty yellowish-white in colour, firm, odourless, varying from a quarter to two inches in diameter, usually circular, but occasionally elongated. The edges were irregular, but sharply circumscribed. These foci could be found in any part of the liver substance, and not infrequently circular haemorrhagic areas up to one inch in diameter could also be met with in the liver. Congestion of the small intestine was also observed, and it was most pronounced in the duodenum. In the liver lesions the presence of a Gram-fast anaerobic bacillus in pure culture was demonstrated. Microscopically the lesion presented the appearance of a coagulative necrosis, surrounded by a broad zone of leucocytes, and immediately within this zone the bacilli were found often in thick felted masses. Occasionally a sporing bacillus with a terminal or sub-terminal spore could be seen. Many of the bacilli were filamentous around the margin, but in the interior they were usually single.

The author now believes that these organisms play a primary rôle in the production of black disease, although in his former communication he was inclined to think that they were secondary invaders, as they were apparently absent from the haemorrhagic areas, which he regarded as the precursors of the necrotic lesions. The evidence, however, shows that these two kinds of lesions have a different pathogenesis, and that the haemorrhagic areas are probably merely the result of early fluke infestation, while the necrotic areas, it would appear, are in all probability the result of a fluke invasion plus a superimposed bacterial invasion.

A short description is given of the morphological and cultural characters of the bacillus, which is quite similar to that of various members of the so-called malignant oedema group. When tested by subcutaneous and intramuscular inoculation into sheep, doses of 0·5 to 1·5 cc. of culture were found to be almost invariably fatal to sheep in from 28 to 78 hours. Doses of 0·1 cc. subcutaneously were usually fatal to guinea-pigs in about 24 hours, while for rabbits the fatal dose was larger, 0·25 to 0·5 cc. Doses of 0·2 cc. injected intramuscularly proved fatal to the fowl. The disease could not be transmitted by feeding, but previous work had likewise shown that the condition could not be transmitted by ingestion of any part of an animal dead from the disease.

The clinical and experimental evidence available regarding the disease shows that it is somehow intimately associated with the prevalence of fluke infestation. Black disease has a seasonal and local distribution corresponding with those conditions most suitable for the propagation of the intermediate host of the flukes. The causal organism of black disease would therefore be a facultative parasite, and the parts most dangerous for sheep would be the springs and moist undrained areas in certain paddocks; the mortality from the disease is, moreover, well known to be highest during those years in which fluke disease is rampant.

The recent investigations with regard to the method of penetration of flukes into the living animal, via the intestine, peritoneal cavity, and through the liver capsule, and not up the bile duct, would also appear to lend further support to this view.

Experiments also showed that measures undertaken with the object of keeping down fluke disease, such as drainage, simultaneously caused a most marked reduction in the incidence of black disease.

Immunisation could be accomplished in the laboratory by the inoculation of sheep with attenuated cultures, for the organism seems to lose its virulence very rapidly on cultivation, but when tested in the field on a large scale the experiments miscarried inasmuch as a marked reduction in mortality also occurred among the control animals, due to the preventive measures that had also been undertaken.

Black disease is in all probability identical with the braxy-like diseases of Tasmania and Victoria, although the organism claimed to be the cause of the latter is not identical with that isolated from the former. It is also quite probable that black disease is identical with the braxy or bradsot of Europe. But definite information upon this point can only be obtained when the causal organisms are submitted to comparative laboratory tests.

GLOSTER (T. H.) & SHANKS (G.). **Report on an Epizootic Disease among Calves at the Amara Dairy Farm.**—*Indian Jl. Med. Res.* 1919. Oct. Vol. 7. No. 2. pp. 382–397.

In this article the authors give an account of some laboratory investigations carried out upon an organism isolated from a disease, not unlike white scour, affecting young calves from one to three weeks old at the Dairy Farm, Amara, Mesopotamia.

The disease was not associated with any very definite symptoms, and in the majority of cases the illness was not recognised until a few hours before the death of the animal. The organism isolated from the lesions was a coliform organism belonging to the Salmonella group [which is held to include *B. paratyphosus* (*B*), *B. aertrycke* (or *suipestifer*) and *B. enteritidis* Gaertner, together also with *B. paratyphosus* (*C*), isolated from human cases of enteric fever, liver abscess, etc., in Mesopotamia]. Cross-agglutination and absorption tests, however, indicated that the organism was different from the *B. paratyphosus* (*B*). and *B. paratyphosus* (*C*), and also possibly from Gaertner's bacillus. It most closely resembled the *suipestifer* bacillus. The bacillus was isolated from the blood, bile, organs, mesenteric glands, and intestinal ulcers of calves that had died from the disease. It was pathogenic for rabbits and guinea-pigs and for calves when given intravenously. The results of agglutination tests carried out with the sera of healthy calves and dams showed, it is stated, that the infection was widespread among the cattle at the Dairy Farm, and that many infected calves recovered. No proof was obtained that the disease was due to a filterable virus, as inoculation of filtered spleen material and blood gave no result upon inoculation into a guinea-pig and rabbit and to a calf, respectively. [From the standpoint of the veterinary investigator, this piece of work appears to have been incompletely carried out.—ED.]

MYCOTIC DISEASES.

Nègre (L.) & Boquet (A.). **Sur le traitement spécifique de la lymphangite épizootique par les cultures stérilisées de cryptocoques.** [Specific Treatment of Epizootic Lymphangitis by Means of Sterilised Cultures of Cryptococci.]—*Bull. Soc. Path. Exot.* 1920. Dec. 8. Vol. 13. No. 10. pp. 777–779.

In a previous note the authors described treatment by the above method (this *Bulletin,* 1918, Vol. 6, No. 3, p. 179), but the results, although very encouraging, were obtained with a small number of horses and had not then been confirmed in current practice. The authors placed at the disposal of several practitioners in France, Northern Africa, and Italy a vaccine which was prepared as follows :— The organisms obtained from cultures four to six weeks old, grown in the incubator at 35° C. on Sabouraud's medium, are collected by means of a spatula, crushed in a dry mortar and emulsified in 0·5 per cent. carbolic acid, so that each cubic centimetre of the liquid contains 5 mg. of culture. The mixture is then heated in a water-bath for $1\frac{3}{4}$ hours at 65° C.

The injections are performed once weekly under the skin of the neck, in increasing doses of 1, 2, 3, 4, and 5 cc. These are repeated until recovery takes place, but the doses given never exceed 5 cc.

During the first four weeks one sometimes observes a slight transient aggravation of the lesions following upon the injections. This need not give rise to any alarm, but the treatment should be continued as indicated. However, if the reactions are too well marked or too prolonged (4–7 days) the dose injected should be diminished in size.

Over 150 horses were injected in this manner, and these animals were affected with more or less severe forms of the disease, affecting the fore and hind limbs, the abdominal wall, breast, neck and withers, or generalised lymphangitis affecting various parts of the body and mucous membranes. Information was obtained only with regard to 86 of these animals. The number cured was 71, or 81 per cent. ; among the failures are included all cases treated during the last stage of the disease, when the specific lesions were contaminated with secondary bacterial invaders, and all cases in which treatment was interrupted for various reasons.

The majority of the veterinary surgeons observed likewise that during the first period of treatment the lesions remained stationary or became aggravated. It was only towards the fourth week that the first signs of improvement became manifest by decreasing suppuration, progressive cicatrisation of opened lesions, and absorption of corded lymphatics and nodules. A few animals, including some severely infected ones, were cured after four injections, but in the majority of cases from eight to ten weekly injections were necessary. The average length of treatment was estimated at two months. One mild and localised relapse in the form of three small nodules was observed. All the practitioners who employed the treatment appeared to be satisfied with the results and the facility with which the treatment could be applied. The animals may remain at work, except perhaps on the day following the injection, when they sometimes show a slight rise in temperature. The sterile abscesses which are produced as the result of the injections become rapidly cicatrised and are not followed by any complication.

The results obtained, in particular by Vet.-Major FORGEOT at the Veterinary Research Laboratory of the French War Ministry, were of such an encouraging nature that the Military Authorities have decided to apply the treatment to all horses affected with the disease in the French Army.

DESCAZEAUX. **Sur la presence de cryptocoques dans le tube digestif d'un cheval lymphangiteux.** [The Presence of Cryptococci in the Digestive Tract of a Horse Affected with Epizootic Lymphangitis.] —*Bull. Soc. Path. Exot.* 1921. Feb. 9. Vol. 14. No. 2. pp. 66–69.

This horse, which died as the result of some digestive disorder, had been treated for epizootic lymphangitis with lesions on each side of the withers and was on the road to recovery. On post-mortem the presence of digestive trouble was confirmed and a search was made throughout the body for cryptococci. They were numerous in the enlarged left prescapular gland, and were also present in the right gland which had previously been enlarged. The axillary gland also showed a few of the organisms. In the thoracic and abdominal cavities no sign of any lesion due to epizootic lymphangitis was seen. The stomach and intestine showed no specific alteration and the mesenteric glands appeared healthy. However, smears made from scrapings of the mucous membrane of the stomach and intestine were found to contain numerous cryptococci, most of them of the usual shape, but some were large and rounded, and differed from those usually found in the pus and external lesions inasmuch as they were less refractile and contained numerous granules. The parasites were very numerous in the stomach, numerous along the whole length of the small intestine, and rare in the large intestine. In the stomach a tumour about as large as a marble was found at the junction of the left and right portions, apparently caused by Spiroptera. On puncture a milky fluid escaped, which proved to be a very rich emulsion of cryptococci, and two adult male and five larval Habronema worms were also found.

Sections were made for histological purposes and stained by Claudius. The Spiroptera tumour appeared to be of recent origin and composed of inflammatory tissue infiltrated with leucocytes and containing very numerous cryptococci. The internal portion seemed to be formed of an actual mass of cryptococci, together with a large amount of debris of the parasites. The middle zone showed an abundant infiltration with leucocytes and contained numerous cryptococci. The free-lying cryptococci were massed together in groups of 10 to 30 parasites forming large rounded masses. Giant cells containing numerous parasites were also seen. The external zone was formed by the gastric mucous membrane. The epithelial cells showed no changes, but between the cells and the lymphatic spaces there were very numerous cryptococci. Sections of the stomach wall showed large numbers of parasites in the submucous lymphatic spaces, but no cellular lesions. In the intestine the lesions were similar, but the cryptococci were less numerous; In certain places the mucous membrane showed actual ulcers in which the parasites could be found. The organisms were sometimes numerous in the region of the solitary follicles. In the submucous coat small capillary haemorrhages could be found and cryptoccoci were seen in the vacuoles.

The parasites observed in the sections showed the usual features; large rounded forms were seen and numerous budding forms, together with small round forms from 1 to 2 μ in diameter. If the decolorisation was pushed too far, the parasites appeared to be refractile and possessed a double contoured envelope.

REID (H. A.). **Notes on Certain Cases of Dermatomycosis of Cattle.** —*Vet. Jl.* 1921. Jan. Vol. 77. No. 1. pp. 21–23.

Reid describes briefly a mycotic skin disease of cattle in New Zealand presenting points of considerable resemblance with a similar condition which has recently been described by authors in Southern Central Africa [see this *Bulletin,* 1920, Vol. 8, No. 3, p. 232, HORNBY, Contagious Impetigo of Cattle in Northern Rhodesia; VAN SACEGHEM, similar condition in the Belgian Congo, this *Bulletin,* 1917, Vol. 5, No. 2, p. 108; see also preceding number of this *Bulletin,* p. 35, for description of the condition known as Saria in the Lake Nyasa District by CURSON.]

The cattle were of the Red Devon breed and were kept under open conditions in a large station. The disease ran a very chronic course, and appeared in some animals to commence on the loins and then spread to their sides, abdomen and legs. The epidermis was greatly thickened and cornefied, and it was fairly easily detached in some places and fairly adherent to the subjacent tissues in others. Removal of the scab exposed a moist, congested surface covered with a sticky greyish exudate with a sour musty odour. The condition did not appear to cause any considerable amount of irritation, the animals did not respond to scratching, and removal of the scabs caused evident pain. The affection caused slight loss of general condition and some degree of fever, up to 103·4° F. One animal, a heifer, presented the condition in such an advanced form that nearly the whole body was covered with thick, greyish scabs, which in some places had become heaped up and projected ½ to 1 inch above the body surface. The heifer was destroyed, as it was in poor condition and exhaled a putrid odour.

Microscopic examination of smears made from the exudate showed the presence of mycelial masses of a fungus, together with some cocci. The necrosis bacillus could not be found. Experimental transmission was then attempted by rubbing some of the scabby material on to the skin of calves with or without previous scarification. In five days the skin became hyperaemic and on palpation the commencing eruption could be distinctly felt. Two days later the skin was rough and covered with firmly adherent scabs; the hair over the inoculated surfaces had not been shaved. In ten days the typical lesions had become formed; a sour, musty odour was noticeable. The skin felt greasy and was tender and painful to the touch. The scabs could now be detached and, on microscopic examination, the same appearance was revealed as in the original cases, except that the mould was not quite so luxuriant. The mould was invariably associated with cocci. Rabbits, guinea-pigs and fowls proved refractory to inoculation.

Cultures on ordinary laboratory media from the material collected from the skin gave rise to a profuse growth of staphylococci. The most satisfactory method for cultivating the mould consisted in enclosing a portion of the scab between two moist chamber slides held together along the edges with wax. These were then placed in a sterile Petri dish lined with damp blotting paper and incubated in the dark at room temperature. Seven days later the mould had commenced to form a conspicuous growth along the edges of the scab.

This growth was sub-cultured into acid agar and gelatine plates. The agar plates, incubated at 37° C., showed after 12 hours the growth of a white mould consisting of a mycelium of branching septate hyphae, showing chlamydospores. Attempts to infect cattle with pure cultures of the mould alone or with the staphylococcus did not succeed. The weather was cold and rather wet at the time, and it is supposed that these conditions might be disadvantageous to artificial inoculations with moulds. The mould appears to the author to simulate to some extent *Epidermophyton gallinae* Megnin, a fungus which causes favus of birds and is inoculable to rabbits, mice and the human subject, but not to rats.

The disease set up by the artificial inoculation of cattle with material from the original cases ran a benign course, and cleared up without treatment in from four to six weeks. Treatment of longstanding cases with 2½ per cent. creolin proved effectual after preliminary washing with soap and warm water. The disease did not seem to show any marked tendency to spread among the herd.

DISEASES DUE TO FILTERABLE VIRUSES.

Velu (H.). **La fièvre aphteuse au Maroc. L'importance de la médication toni-cardiaque.** [Foot-and-mouth Disease in Morocco, Importance of Administering Cardiac Tonics in Treatment.]—*Bull. Soc. Path. Exot.* 1920. Nov. Vol. 13. No. 9. pp. 726–729.

Foot-and-mouth disease has long been recognised in Morocco, where it is known to the natives as " Bou Jder " or " Bou Jedri "—terms which include all eruptive contagious affections, such as sheep-pox, small-pox, cow-pox, and fowl-pox. Among ruminants the condition generally runs a mild course, but from time to time outbreaks of exceptional severity occur. Such outbreaks were observed about 20 years ago, again in 1913, and in 1920. The more severe forms of the disease occur in cattle subjected to much fatigue or bad hygiene, and in pigs herded together before or during shipment. In these conditions deaths are not rare and convalescence is of long duration. In the 1920 outbreak the milk production of the herds of Spanish goats at Casablanca diminished considerably. Young sucking animals were found to be much more susceptible than were adults, for calves and lambs succumbed in large numbers to the septicaemic forms of the disease. In the mild forms usually observed in adults discrete lesions are to be found above the claws, which cause very slight lameness, lasting three or four days at most, while typical lesions on the lips and tongue, which cause a little difficulty in swallowing for two or three days, are also seen. Very rarely, lesions are found on the udder. Buccal lesions were seen on two gazelles. The disease never lasts longer than a week, and natives who do not also carry on pig breeding attach no importance to the affection.

The virus appears to be endowed with a high degree of pathogenicity for the pig. Adult animals exhibit only localised lesions on the mouth, mammary glands or feet, usually of a mild character. In 1913 the foot lesions appeared to be more intense, because the animals were kept entirely at grass during the course of the outbreak (May–October). In young pigs, on the other hand, the disease became manifested under various forms, which were often septicaemic and of exceptional severity. Four main forms were recognised, viz., (*a*) buccal form, with more or less confluent vesicles on the lips, tongue and gums ; (*b*) the foot form, with congestion of the coronary region, interdigital vesicles, and necrosis and very often sloughing of the claws, in about 40 per cent. of cases ; (*c*) alimentary form, with severe general symptoms and typical lesions of gastro-enteritis ; (*d*) pulmonary form, with diffuse bronchitis and pneumonic centres.

In all the severe outbreaks the high mortality has to be attributed to the cardiac lesions, and death supervenes very often from cardiac syncope without preliminary signs. Cases of sudden death occur in animals during the hotter periods of the day, when they are made to move, and sometimes animals in very good condition with mild or healing lesions succumb in this manner. Post-mortem, myocarditis is always marked. Treatment of the local lesions in young pigs therefore becomes a secondary consideration, and cardiac tonics are more indicated. Velu used camphorated oil to this end and the results were very encouraging. In one large establishment containing over 10,000 pigs this treatment was applied to 200 young pigs. Mortality ceased in two days, although it had amounted to four or five per day prior to the injections.

ZELLER (H.). **Über Pocken bei Ziegen Sudwestafrikas.** [South-West African Goat Pox.]—*Arbeiten a. d. Reichsgesundheitsamte.* 1920. Oct. Vol. 52. No. 3. pp. 501–537. With 7 figs. and 2 tables.*

This research was conceived on the receipt from a veterinary officer in (then) German South-West Africa of scab material preserved in 50 per cent. glycerine. A short accompanying descriptive note stated that goats in the sender's district showed black warty growths round the mouth and nose, which on removal left a patch of raw underlying tissue. Kids were stated to be mostly affected, but sheep contracted the affection also. The course of the disease was usually favourable.

The material, soaked and softened by the glycerine, was obviously a conglomeration of scabs, hair and dirt, of macerated consistency and brownish colour.

Microscopic and cultural examination revealed the presence of many organisms, mainly *B. subtilis* and *Staphylococcus pyogenes albus.* Neither of these were considered to be causal, but cultures both of the whole material and of the isolated coccus were inoculated by scarification on to an adult goat and a kid. Beyond the development of a few pustules, which soon disappeared, no result was obtained.

Inoculation by scarification of the original material on the muzzles of goats and kids reproduced the disease as reported by the sender. The course in detail was as follows :—

On the second or third day, earlier in kids than in adults, pronounced redness and swelling appeared, which increased during the following day or two. Now a yellowish glairy fluid was secreted, which rapidly hardened to form a yellowish-brown scab. The lesions tended to spread somewhat, reaching a maximum at the 8th to the 12th day. Where the scabs cracked there was further oozing of yellowish fluid, which again dried as usual. Meanwhile, at about the 5th day in kids, or a day or two later in adults, small red spots appeared at the commissures of the lips, about the junction of the skin and mucous membrane. These developed into papules up to the size of a pea, and if pulled off at this stage a bleeding, slightly suppurating, granulating surface presented itself; if left alone scabs eventually formed, or in some cases pustules followed by scabs.

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* Abstracted by Mr. S. C. J. Bennett, B.Sc., M.R.C.V.S.

From the 12th to 16th day, earlier in adults, the lesions began to clear up, the scabs dropping off, leaving a complete new skin with young hair. It is to be specially noted that in no case was necrosis observed, but in the case of pigmented lips the pigment was not reproduced, so that the lips of recovered animals were blotched with white areas.

At about the same time that the papules appeared at the commissures of the lips, or about a day later, small, sharply circumscribed, inflammatory areas developed on the buccal mucous membrane, accompanied by increased salivation. These started as pinhead papules and developed into raised plaques up to a centimetre in diameter. Their surface turned from white to yellowish, becoming eventually shed to leave a sharply defined, meagrely suppurating defect, which healed completely in five to eight days, leaving no scar. In some cases, before the ulcers healed, papillomatous outgrowths of considerable size developed, but the result was always healing without a scar. In addition to the foregoing, some subjects showed, particularly on the tongue and gums of the lower jaw, cord-like proliferations of the mucous membrane, either plain or dividing, but these, as all other lesions, eventually healed. On the mucous membrane, as on the skin of the lips, no sign of necrosis was ever observed, and after recovery no scar remained.

As a result of inoculation on the muzzle, some goats and kids developed cutaneous lesions, mainly about the head and neck, but not confined to these regions. The lesions were very similar to those on the skin of the lips, and on healing no scars remained, with one exception; this was a she-goat suckling a kid, and repeated pulling off of the scabs caused a few small scars to persist. However, in no case did any suckling female develop signs of mastitis.

Systemically, kids became fevered, would not suck, and lost condition, but never had diarrhoea. The adults, on the other hand, presented no systemic symptoms.

On the whole the kids were the more severely affected; symptoms set in earlier after inoculation, the course was more acute and they lost more condition, although no deaths occurred. Both in kids and adults the period from inoculation to complete recovery was three and a half to four weeks.

Further inoculation experiments, either with or without scarification, proved the infectivity of the material to other parts of the body—skin, lips of the vulva, lower surface of the tail, etc. Instillation of material into the eye was followed only by a very mild conjunctivitis, which soon cleared up, leaving no trace. Natural infection by contact was also observed.

Test inoculations as to transmissibility to other domestic animals failed to reproduce the disease in horses, dogs or pigs. A transient local lesion following scarification appeared in two heifers out of four in which transmission was attempted. Sheep and lambs proved to become affected to the same degree as goats and kids. Small laboratory animals were completely unresponsive, no lesion being produced on the cornea of rabbits even after scarification.

That the virus is very contagious was proved by keeping sound animals in contact with infected ones; they invariably became infected and, moreover, the disease was found to spread with equal facility from sheep to goats, and conversely. The disease even spread to some animals at a distance and to some at grass. Convalescents, however, were noticed to be harmless. In spite of this observed extreme contagiosity, attempts to cause infection with blood, milk, saliva or urine of infected animals failed.

Microscopic examination of the blood, either fresh, in hanging drop direct, or by dark ground illumination, or of smears stained in various ways, gave no clue as to the nature of the cause, and showed no specific alterations which could help from a diagnostic standpoint. Similar examinations of scabs from the local lesions, as in the case of the original material, showed a variety of non-specific bacteria only. In addition, all attempts at cultivation, whether from blood or organs, failed; moreover, no macroscopic lesions attributable to the disease were to be found in any part of the body; it is particularly to be noted that the presence of a true vesicle, considered to be a classical stage of pox, was never observed, the earliest stage always being a papule or pustule.

Histological examination of skin and mouth lesions showed nothing of importance. The ordinary phenomena of inflammation and abscess formation, together with some fibroblastic activity and granulation, were the only alterations observed. Particular care was exercised in examining sections of cornea from rabbits infected in this position by scarification. The only information so derived was that keratitis developed approximately in proportion to the severity of the scarification; in no case could the presence of intracellular bodies (*Guarnieri bodies*) be demonstrated.

The presence of immune bodies in the blood of infected animals was demonstrated by the precipitation test. An extract of scab material (filtered) gave positive results with the serum of infected animals, and not with that of sound animals. A control extract was used consisting of an extract similarly prepared from the skin of the lips and nose of healthy animals. Incidentally, it was found that positive results were only to be obtained with a strong (10 per cent.) scab extract; moreover, boiling of this extract destroyed its usefulness. Unfortunately, shortage of material and other circumstances prevented the author from studying this question on a more comprehensive scale.

Several experiments were performed to ascertain the viability of the virus. As already noted, the material sent from South-West Africa in 50 per cent. glycerine was alive at the end of three months. After the European war, during which period these experiments were left in abeyance, the glycerined material was found to be avirulent, *i.e.*, after 4¾ years. Dry scab material, left in ordinary plugged tubes for the same period, was found to be still virulent, although at a first inoculation only a mild form of disease was induced. Scab extract, once brought to the boil over a flame, was inactivated completely, and heating at 70°–80° for one hour had the same effect; one hour at 60° reduced its vitality considerably. Putrefaction at room temperature had little effect, but in an incubator at 37° C. the virulence diminished gradually, to be entirely lost after 53 days. In an ice chest, 90 days was the period required. Short exposure to chemical disinfectants has little effect; for example, 5 per cent. solutions of creolin, antiformin and carbolic acid, or 1–1,000 corrosive sublimate did not kill it in five minutes. A 1–1,000 solution of sublimate was found to kill it in 24 hours.

The question of filtrability was unfortunately not definitely settled. A glycerine extract filtered through asbestos and centrifuged showed the clear supernatant liquor to be infective, and filtration through Berkefeld filters of varying densities passed a fluid which proved infective in one-third of animals tested. The results were too equivocal to warrant a definite conclusion, and, unfortunately, the author was unable to repeat the experiments more extensively.

Immunisation experiments afforded some useful information. Recovered animals had a strong, durable immunity. The longest period tested was seven months, but immunity against experimental inoculation was still absolute. Blood inoculation, either with serum or defibrinated blood of affected or recovered animals, afforded no immunity whatsoever, and likewise the killed virus in scab material had no effect. On the contrary, subcutaneous injection of a glycerine extract of virulent material produced a strong immunity. This resistance developed slowly, as it would not prevent infection after a week, but was absolutely protective after three weeks. Intraperitoneal injection of similar material induced no immunity.

In conclusion, some discussion is raised as to the actual nature of the condition under consideration. On the whole it appears to be pox, but some of the recognised, or most postulated, features are absent. In the first place no true vesicular stage was observed, and, further, no intracellular enclosed bodies were found, either in the lesions of the affected animals or in the cornea of inoculated rabbits. These discrepancies, if such they be, are not to be too seriously considered, for the variolae of animals, excepting those of cattle and sheep, are almost unexplored fields. Again, it may be that there is no such condition as true goat-pox; it may be that it is only a modified or atypical form of some other variola—cow-pox or small-pox. It is known that atypical forms are found on the natural subject of a true variola; might not the lack of certain classical features be so explained? Reports of other observers, particularly in Africa, are mentioned in which conditions are described not differing very much from the one under consideration. It appears that a good deal more work on the subject is indicated to co-ordinate the information to hand and, perhaps, to attempt some cross-immunological differentiation.

SCHERN (K.). MAVRIDES (N.) & MAJOR (A.). **Über Rinderpest (Vierte Mitteilung). Über die Wirkung des von anatolischen und podolischen gewonnenen Rinderpestserums für Friesländer Rinder nebst Beobachtungen über *Piroplasma parvum* (Ostküstenfieber) in der Türkei.** [Rinderpest (4th Communication). Concerning the Action of Rinderpest Serum obtained from Anatolian and Podolian Cattle on Friesians, together with some Observations on *P. parvum* (*Theileria parva*—East Coast Fever) in Turkey.] —*Zeitschr. f. Infektionskran. d. Haustiere.* 1920. July. Vol. 21. No 1. pp. 82–96.*

The primary object of this research was to ascertain the immunising power of rinderpest serum obtained from hyperimmunised cattle of the local breed when injected into European cattle. The local breeds, through centuries of exposure to cattle plague, have attained some degree of racial natural immunity, and consequently do not react so strongly to the virus of the disease as do the more finely bred and less exposed European breeds. Ordinarily, the serum from hyperimmunised local cattle is used for the protection of other cattle of local breed, and experience has shown it to be of sufficient potency. Incidentally, as some of the serum producers may be carriers of piroplasmosis, a rule is made never to inject serum unless it has been allowed to stand for at least two months. This ensures the death of any piroplasms present, and is superior to filtration in that it does not reduce the potency of the serum. The dose is calculated at 0·25 cc. per kilogram body-weight (in the case of local cattle) in order to confer an immunity of 12 days' duration.

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* Abstracted by Mr. S. C. J. Bennett, B.Sc., M.R.C.V.S.

In the experiments on Friesian cattle it was established that four times the normal dose for local cattle (1 cc. per kilogram body-weight) conferred an immunity of at least a month's duration, and that a smaller dose (0·6 cc. per kilogram body-weight) injected every 12 days would probably protect the treated animal for an indefinite period. The animals so treated were kept in the same stable as cattle suffering from rinderpest, and they did not subsequently show any symptoms of the disease, whereas two control animals, similarly housed, succumbed at the ninth and twelfth days respectively. The two foregoing tests were conducted with two months' old unfiltered serum, but a third test, similarly controlled, showed that a dose of 0·7 cc. per kilogram body-weight of fresh filtered serum would not afford an absolute immunity; a cow so treated developed rinderpest in a mild form and soon recovered.

A further test with a dose of 0·5 cc. per kilogram body-weight of two months old unfiltered serum showed that this quantity would not protect absolutely; the cow employed in the test developed mild symptoms on the eleventh day, and a further dose of 500 cc. was administered. This dose effected what was apparently a complete cure.

Incidentally, after an interval of about a week, this cow contracted, and ultimately succumbed to, East Coast fever. Autopsy revealed typical rinderpest ulcers which were undergoing regeneration in the abomasum—an incident which is of particular interest in view of the extremely mild clinical symptoms shown previously.

To test the purely curative value of the serum another Friesian cow was allowed to contract the disease naturally, and as soon as definite symptoms developed a dose of 500 cc. of unfiltered serum was given *intravenously*. As no apparent benefit was evinced a similar dose was given on the next day, and again on the following day. In spite of this treatment a very high temperature and great depression were maintained. After missing one day, two more daily doses of 500 cc. were given intravenously, with the result that the temperature was restored approximately to the normal, although the depression remained and a profuse diarrhoea set in. To compensate for the diarrhoea two doses on consecutive days of four and two litres respectively of physiological saline were injected subcutaneously. From this point onwards recovery was uneventful.

This animal also ultimately fell a victim to naturally acquired East Coast fever, and on post-mortem examination (three weeks after the commencement of clinical symptoms) typical rinderpest ulcers were seen in the abomasum in the retrogressive stage.

The conclusions to be drawn from the foregoing experiments are :—

1. European cattle require rather more than double the dose of serum given to local cattle to protect them against rinderpest. (The dose for local cattle is 0·25 cc. per kilogram body-weight, whereas the lowest absolutely protective dose for a Friesian cow was 0·6 cc. per kilogram.
2. Fresh, filtered serum is less efficient than older, unfiltered, serum.
3. A dose of 0·5 cc. per kilogram body-weight will not protect European cattle, but will delay the appearance of symptoms. Further, an animal so treated may be cured if given a larger dose when symptoms first appear.
4. As a curative only, the serum is useful only in the form of exceedingly large and repeated doses, and even then, the treatment must be commenced at the very first appearance of clinical symptoms.
5. European cattle are very susceptible to East Coast fever. Resulting from this fact, it was to be observed that in animals which had shown only mild clinical symptoms of rinderpest the internal lesions were nevertheless very pronounced.

SCHERN (K.). **Über Rinderpest (Fünfte Mitteilung). Befunde bei Rindern nach überstandener, experimenteller Rinderpestinfektion, mit einem Anhang über Schlachtbefunde bei Rindern in Konstantinopel.** [Rinderpest (5th Communication). Conditions observed in Cattle following Recovery from Experimentally Induced Rinderpest, with a Further Note on Slaughterhouse Observations in Constantinople.] *Ztschr. f. Infektionskr. d. Haustiere.* 1920. Nov. Vol. 21. Part 2. pp. 122–137.*

This article follows previous communications by the author (see this *Bulletin,* 1918, Vol. 6, No. 3, p. 186), in which mention has been made of the recovery of cattle experimentally infected with rinderpest. The animals here studied are those which were among the cattle destined to supply virulent blood, but which, owing to their mild reaction (or total absence thereof) to experimental inoculation, and rapid recovery, were rejected as unsuitable for that purpose. Anatolian cattle only are considered, as European beasts were not available (at Pendik, Turkey).

Post-mortem examinations were made of 131 such cattle which were slaughtered at varying periods up to 155 days after experimental inoculation, particular attention being paid to the abomasum and heart as the two predilection seats of lesions. On the results of these autopsies the author classes the beasts in four groups :—

(1) Those which exhibited symptoms and which, on autopsy, showed no lesions of rinderpest (35 beasts).

(2) Those which exhibited symptoms and which, on autopsy, showed some lesions (50 beasts).

(3) Those which *exhibited no symptoms but, on autopsy, showed lesions* (34 beasts).

(4) Those which showed neither symptoms during life nor lesions when slaughtered (12 beasts).

Of these groups, the most interesting consists of animals which showed no symptoms following inoculation but nevertheless developed internal lesions—in one case, lesions were present on slaughter 155 days after inoculation.

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* Abstracted by Mr. S. C. J. Bennett, B.Sc., M.R.C.V.S.

The persistence of these lesions naturally suggested the possibility of continued infectivity after apparently complete recovery, and in order to investigate this point it was decided to inoculate other cattle with material from the internal lesions.

In the first experiment of this series, portions of the abomasum showing lesions obtained from a recovered beast slaughtered 26 days after inoculation were minced up, mixed in a bran mash, and fed to two healthy Anatolian beasts. These two beasts were kept isolated from all others in an open paddock with an attendant who lived with them. Nobody else was allowed to approach them, so that as far as possible the most rigid measures were in force to prevent the introduction of rinderpest from without. Of these two experimental beasts one developed symptoms of high fever on the eleventh day and died on the fifteenth. Autopsy showed it to have died from a peracute form of rinderpest—severe gastro-enteritis with haemorrhages and infiltration into the wall of the intestine, together with distension of the gall bladder with green diffluent bile. The second beast showed no symptoms with the exception of a slight rise of temperature on the eighth and ninth days, and in consequence some doubts were entertained as to its susceptibility. To make sure, a dose of 10 cc. of virulent blood was given. Following upon this inoculation the animal remained quite normal for twelve days, but at this period developed a temperature of 40·5°C. (105°F.) which did not subside, accompanied by colicky phenomena. It died in three days. Autopsy showed evidence of severe sero-fibrinous peritonitis and examination of blood-smears showed evidence of anaplasmosis. The author therefore concludes that this beast did not die of rinderpest and was consequently immune.

Material for the next experiment was minced abomasum tissue of a beast which had been slaughtered as immune to rinderpest, and which at post-mortem examination showed *no lesions*. A beast fed with this material did not show any definite rinderpest symptoms, but neither did it when tested as to its susceptibility by inoculation with 20 cc. of virulent blood. It was slaughtered, but no lesions of rinderpest were found. This experiment must, therefore, be discarded, as the experimental animal was presumably naturally immune, so that no conclusion can be drawn as to the virulence of the experimental material originally given.

Attempts to produce rinderpest by feeding with material from the abomasum lesions of a recovered beast slaughtered 70 days after inoculation, from which it had recovered, also failed; but here again the two animals tested subsequently resisted natural infection by co-habitation with animals at the height of the disease.

Further attempts at infection with similar material from two cattle recovered from mild clinical rinderpest slaughtered 105 and 108 days, respectively, after inoculation with virus also failed.

Results of experiments up to this point tend to show that cattle which have to all outward appearances completely recovered from rinderpest, may, nevertheless, be possible carriers of infection, since material from such a beast slaughtered 26 days after inoculation with virus produced fatal rinderpest in one test animal fed with it, and a very mild attack in another. Material from recovered beasts slaughtered at 70, 105 and 108 days after inoculation failed to reproduce the disease, but material from a 101 days' case produced doubtful, mild symptoms. The argument is thus that although all recovered animals are not infective, nevertheless, as seen by experiment, some of them may harbour the virus. It also appears that as material used 26 days after inoculation produced fatal rinderpest and that used after 70, 105 and 108 days did not, the danger decreases as time after recovery progresses.

As a sequel to the foregoing researches, investigations were instituted in order to establish whether beasts slaughtered for food, and, therefore, apparently healthy, still showed lesions. Examination of about 60 carcases in the slaughterhouses of Constantinople showed that about 75 per cent. still harboured rinderpest lesions in the abomasum or heart.

A summary of these researches, therefore, shows that of 131 cattle inoculated with rinderpest virus in which severe symptoms did not develop, 35 beasts (28 per cent.) showed mild symptoms and recovered ; moreover, on post-mortem examination, no persisting lesions were seen. Of 50 beasts (38·1 per cent.) showing similar symptoms, persisting lesions *were* seen on post-mortem examination, even up to 140 days after inoculation.

Again, the fact that an inoculated animal shows no symptoms does not necessarily imply that it has not developed the disease, since in 34 beasts (25·9 per cent. of such cases) post-mortem examination revealed rinderpest lesions. Such a conclusion is, however, warranted in some cases, since some beasts showed neither symptoms nor post-mortem lesions.

Furthermore, feeding experiments with material from persisting lesions demonstrated that it is possible for the virulence to persist also, even up to 101 days. The degree of virulence appears to decrease with time.

The discovery of persisting rinderpest lesions in apparently sound cattle in slaughterhouses is of great importance, as such beasts may have been harbouring infection and have probably been driven long distances over the main roads. They may thus have been disseminating the virus of the disease. Thus, from the national economic standpoint, a country can only protect itself against the introduction of rinderpest by the absolute exclusion of animals coming from a country in which the disease is indigenous—even a lengthy period of quarantine may not suffice, since the disease may exist although it is impossible to establish the fact.

i. RUPPERT (F.). **Gibt es bei Rinderpest Virusträger** [Do "Carriers" of Rinderpest exist ?]
ii. SCHERN (K.). **Ja ! Es gibt Virusträger bei Rinderpest.** [Yes ! Rinderpest "Carriers" do exist.]—*Berliner tier. Woch.* 1921. Feb. 24. Vol. 37. No. 8. pp. 85–88.*
iii. RUPPERT'S **Concluding Remarks.**—*Ibid.* Mar. 17. No. 11. p. 126.

The discussion of the above question, following as it does the foregoing articles, is of particular interest and is quoted at some length.

i. RUPPERT'S CRITICISMS. SCHERN'S conception that there are carriers of rinderpest arises from a single positive transmission experiment. A bullock was slaughtered 101 days after infection and ulcers from its abomasum fed to a second beast, which developed clinical rinderpest.

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* Abstracted by Mr. S. C. J. Bennett, B.Sc., M.R.C.V.S.

The other positive case wherein similar ulcers from a beast slaughtered 26 days after inoculation proved infective, cannot be admitted as evidence, since it has been established that the blood of a chronically affected animal may be virulent up to 30 days. (HUTYRA and MAREK, *Die orientalische Rinderpest.* 1916.) Thus, based on a single experiment, conducted without any control, SCHERN attempts to strike at the root of our preconceived ideas of immunity. I do not need to offer any suggestion as to the explanation of this single positive result carried out at a rinderpest station. The other arguments resulting from field tests are only hypotheses and, so far, not established.

Rinderpest immunity differs from any protozoan immunity, and no comparison of the two can be entertained; moreover, there are fundamental differences between rinderpest and other contagious diseases in which carriers are recognised (*cf.* typhoid fever).

Admittedly it is not always possible to establish the origin of rinderpest outbreaks, and their instigation by carriers would be sufficient explanation. However, theories are no good. The last outbreak in Belgium, first thought to have originated from carriers, has since been proved to be due to another cause—some zebus quarantined in Antwerp were not healthy, in fact seven of them died. There is no information as to whether any of them had died in transport, but it is likely that they were injected with rinderpest serum in Bombay. No other information is to hand.

According to a Russian commission (*cf.* HUTYRA and MAREK, *loc. cit.*), the virus of rinderpest may remain alive in the marrow of dried bones for 30 days, and for a similar period in incompletely dried hides which had been salted for two or three days. BOYNTON (*Philippine Jl. of Science*, 1913, Vol. 8) proved the persistent virulence of blood in a leech for 25 days, and WÖLFEL was able to infect animals with material from bones which had been buried for a month and dug up again. From these facts, it is to be realised, that very little is really known of the rinderpest virus, and, consequently, a clear scientific explanation as to the cause of any particular outbreak cannot be put forward.

Against the single positive experiment of SCHERN, one must consider the results obtained by MROWKA (*Ztschr. f. Infekt.-Krankr. d. Haust.*, Vol. 15, p. 139), by WARD, WOOD and BOYNTON (*Philip. Jl. of Science, B., Trop. Med.*, Vol. 9, p. 49), and by WÖLFEL and myself. MROWKA, in China, fed susceptible animals with old abomasum ulcers from rinderpest carcases, but failed to reproduce the disease. WARD, WOOD and BOYNTON, in the Philippines, investigated the possibility of recovered animals being able to infect others by direct contact; all attempts failed. WÖLFEL and myself inoculated susceptible animals with as much as three litres of blood from recovered beasts, but failed to reproduce the disease in any case.

I do not wish to contradict SCHERN's theory on the grounds of these researches alone, but should like to point out that it is not definitely established that the ulcers of the abomasum, as described by SCHERN and MROWKA, were unequivocally referable to antecedent rinderpest. In East Africa exactly similar lesions have been observed by us in cases of East Coast fever. LICHTENHELD, as early as 1905, described them in regions to which rinderpest was entirely foreign, and they were considered to be in the nature of emboli consisting of masses of KOCH's blue bodies. At Mpapua it was definitely proved that animals were in possession of such lesions, but were not affected with rinderpest, and therefore the lesions were in no way referable to rinderpest.

A further interesting point is as follows:—In East Africa, before the war, rinderpest was enzootic as far as the Central Railway (*Mittellandbahn*), but south of this line the country was free from the disease. Realising that animals from the hitherto free district would be good subjects for the provision of virus, we brought a number of them to our institute for that purpose. We found on inoculation of various lots that from 2 per cent. to 5 per cent. were immune. They must have become immune as a result of previous infection, so that one may assume that as they came from a district carrying 200,000 head of cattle, there would be, say, 4,000 such immune animals—presumably recovered animals. It seems reasonable to suppose that among this 4,000 there would be a few carriers. Such appears not to have been the case, as no outbreak was ever observed prior to invasion of the territory by the allied armies in 1917.

SCHERN's opinion that carriers exist, would suggest that immunisation by the simultaneous method is hazardous; carriers would of necessity be created, and these would infect young beasts, so that rinderpest could never be stamped out. The weight of evidence is in direct opposition to this, particularly in countries where a strict veterinary inspection cannot be enforced. MARTOGLIO (*Ann. d'Igien. sperim.*, 1911, Vol. 21, No. 2), in Eritrea, attempted, side by side with each other, the serum-alone and the simultaneous methods; he considers the simultaneous method the better. Again, in Russia, VON OSTERTAG (*Ztschr. f. Infekt.-Krankr., etc., d. Haust*, 1917, Vol. 18, p.1) states that attempts to put down rinderpest by the serum-alone method failed, owing to the fact that a protection of sufficient duration could not be produced; the simultaneous method, however, afforded good results. Moreover, in districts cleared of the disease, no further outbreaks occurred. In fact all information as to the sequelae of simultaneous anti-rinderpest inoculation in Eritrea, Russia, the Caucasus, Egypt, India, Turkey, Abyssinia, East Africa and the Philippines contra-indicates the possible existence of carriers. If the existence of such is to be established, the fact must be proved with a larger amount of material and on much broader lines.

ii. SCHERN'S ANSWER. I cannot agree with RUPPERT, and I do not think that my communication was made without sufficient confirmation. I have performed experiments, and when RUPPERT can present any facts which refute my results I will concur with his "opinion" (*Ansicht*). RUPPERT knows that a single positive result is determinative in spite of any number of negative ones. Carriers of rinderpest are not easy to come by, and fortune has not smiled on RUPPERT and the others; however, that detracts nothing from the correctness of my experiments. Moreover, I do not stand alone in my conclusions, as shown by GÄRTNER'S work (*Berliner. tier. Woch.*, 1920, No. 43), in which he heads a section of his work "Goats as virus carriers in rinderpest." STAZZI has also demonstrated the existence of carriers.

The suggestion that the experiments were not sufficiently controlled is incorrect, and for that matter anybody, even in Germany, can convince himself that feeding with normal abomasum tissue will produce no phenomena which might be confounded with rinderpest.

As to the experiments having been conducted at a rinderpest institute, such work is usually done at these places—for instance, foot-and-mouth disease experiments are performed at the foot-and-mouth disease institute at Rheims. Who, therefore, can agree with RUPPERT'S words when he says: "I need offer no explanation as to the value of researches conducted in such an institution"? The experiments were carried out "near" (*bei*) a rinderpest station, but in the open, and I hold that it is in connection with such an institute that experiments of this nature should be conducted; the whole matter turns on who does the experiments and how they are done. With all modesty, I may remark that I am no beginner at this kind of work, but have fifteen years of practical experience behind me.

It is not clear why any reference should be made to the difference between immunity to rinderpest and to protozoan diseases, and as to the persistence of infective virus in bones or hides: the question here is of carriers—living animals; moreover, there is a great difference between an animal with a chronic form of rinderpest and one, to all clinical appearances, completely healthy.

MROWKA is of the same opinion as myself, although similar feeding experiments in his hands, and in the hands of several other authors, produced no results. As shown in my original communication, many of my feeding experiments were also negative.

Referring to the work of WARD and his collaborators, the difference between virus "carriers" (*Virusträger*) and virus "spreaders" (*Virusausscheider*) is ignored. The experiment of putting recovered animals in contact with non-susceptible ones, cannot prove whether the former are carrying the virus, but only whether they are excreting it, and, moreover, in sufficient mass to cause infection of the latter.

As to the possibility of confounding a rinderpest ulcer in the abomasum with a lesion of East Coast fever, this is a question that is being investigated by histologists, and the information to hand is not very definite. A practical acquaintanceship with the two diseases induces one to discard any tendency to admit their identity.

In consideration of the estimated 4,000 immune animals south of the Central Railway which are in contact with 200,000 susceptible animals, apart from noting that the question is here rather of "spreaders" (*Ausscheider*) than of "carriers" (*Träger*), I should like to ask how many of our European cattle would withstand infection in the same circumstances ?

The question of carriers appears to be of great importance, especially from the standpoint of simultaneous inoculation, but it is impossible to make any categorical statement as to the advisability of the latter. The question is extremely complicated from economic, medical and political points of view. However, confining one's considerations to countries in which rinderpest is enzootic, one cannot agree with RUPPERT's statements Among the countries quoted Turkey is mentioned, and I know from my own experience in Asia Minor, that the Turks discarded the simultaneous method of immunisation years ago, because so many secondary outbreaks followed this procedure. The serum-alone method only is employed.

The conclusion is that the answer to RUPPERT's query must be : "Yes, carriers of rinderpest do exist."

iii. An explanation is here given as to what would be adequate controlling of the rinderpest transmission experiments cited by SCHERN (see 5th communication and discussion above). RUPPERT says :—

"If I were performing a similar experiment to that of SCHERN on a beast in the vicinity of a rinderpest institute, I should consider it necessary to have two or three healthy animals alongside the experimental one, in order to be able to exclude the possibility of infection from without through the medium of food, water, insects, men or other animals. With the first rise of temperature (in the experimental beast) the control animals should be isolated and continue in a state of health."

MISCELLANEOUS.

DONATIEN (A.) & ESPÉRANDIEU (G.). **Le "Boukhchem," maladie enzootique des chiens kabyles.**—*Bull. Soc. Path. Exot.* 1920. Dec. 8. Vol. 13. No. 10. pp. 811–816.

Mention has already been made of this canine contagious disease by HECKENROTH in Senegal, 1916 (this *Bulletin,* 1918, Vol. 6, No. 4, p. 250), by VELU and by MARTEAU in Morocco in 1918 and 1919 (this *Bulletin,* 1919, Vol. 7, No. 4, pp. 286 and 287), and a violent outbreak was observed by the authors in the Department of Constantine in Algeria in December, 1919, to April, 1920. It had already been described in this district by Donatien in 1911 and 1912. A considerable mortality took place among the kabyle dogs, and very few escaped infection in affected villages.

The first sign of disease in the dog is a coryza manifested by a more or less abundant serous discharge, and by a pruritus which causes the animal to rub its face as if in an attempt to expel parasites from its nasal cavities. The chief signs of the disease soon supervene, which may be divided into nervous and respiratory symptoms. One may also note digestive, urinary and circulatory derangements as accessory signs. The nervous symptoms are by far the most marked and are seen in almost all cases. They exhibit considerable variation in nature and intensity in different subjects, for in some they may take the form of locomotor troubles, while in others they may be seen as sensory troubles. The locomotor troubles take the form of marked changes in the attitude and progression. The affected animals carry their heads low, walk with unsteady gait, and there is often incoordination between the movements of the fore and hind quarters. The subjects frequently fall, and weakness of the hind quarters becomes more marked until it develops into paresis or even paraplegia. Clonic contractions of certain muscular masses are very often seen, especially in the region of the loins and croup, while sometimes tetanic contractions of the neck may be seen.

Hyper-aesthesia is almost constantly noticeable at the back of the neck, and it may be seen on the croup. The sensory organs remain most commonly unaffected, but sometimes disturbances of the visual apparatus may be seen, while in some cases the dogs become quite deaf.

Animals preserve their intelligence and only very rarely exhibit madness, their attitude being more usually that of profound depression. The sympathetic system is affected, so that one may observe clonic contractions of the diaphragm and pharyngeal spasms, leading to total or incomplete inability to swallow.

Respiratory symptoms are less commonly observed, but most often they appear simultaneously with the nervous disorders, but in a few rare cases they may appear alone. The serous discharge becomes mucous and then muco-purulent, and increases in amount, it then dries up in the form of brownish crusts around the nose, hence the native designation "Boukhchem" (disease of the nose). Dogs sneeze, but cough very little, whilst they are affected with intense dyspnoea after the least effort. Dyspnoea may, moreover, be seen without any other respiratory trouble. The appetite and thirst are usually maintained. Besides nervous vomitions, the animals may have diarrhoea, and in cases of paraplegia there is retention of the faeces and urine. As a rule the urine is opaque and dirty looking, sometimes reddish. The pulse is small and thready, the general condition is severely affected, although the appetite is maintained, and emaciation becomes more and more marked until the dogs die in a condition of extreme weakness. Death takes place after a variable interval of time (3 to 20 days), but in rare cases it may take place after even 2 to 5 or even more months. The more chronic cases are those in which the nervous symptoms only are seen. The high mortality leads to the extinction of dogs over fairly considerable regions.

Examination for the presence of lesions was made particularly in connection with the nervous and respiratory systems. The cerebral and spinal meninges were congested. The cerebro-spinal fluid was abundant and turbid, the nerve centres showed a little congestion. In two cases, acute unilateral pleurisy with broncho-pneumonia of the opposite side was seen. No parasites were found in the sinuses. Signs of intoxication were noted in connection with the other organs. In nearly all cases swellings due to *Spiroptera sanguinolenta* were noticed along the course of the intra-thoracic portion of the oesophagus.

Etiology.—The disease was identifiable with certainty only in the dog and almost entirely in the kabyle dog. During the progress of an outbreak the European breeds of dogs may likewise become affected, but the disease develops in them in a mild form. Hybrid dogs appear to possess an intermediate susceptibility, and in them especially may be noted all cases of incomplete recovery with persistence of nervous troubles. In the native breed age plays no part. The disease appears particularly during the colder months. It appears in a centre and then spreads from one native group to another with a certain rapidity. In the last observation it spread a distance of 50 km. in two months. Clinical observation throws no precise light on the nature of the mode of transmission. In view of the fact that madness is but rarely seen, it is but little probable that the virus is transmitted by biting. In the villages the animals live in very close proximity, and it would thus appear highly probable that the serous discharge seen at the beginning of the disease contains the virus.

Experimental investigation, however, gave but little better results than clinical observation, and attempts at transmission by cohabitation, smearing of nasal discharge, and injection of blood gave negative results. A dog, however, inoculated with brain material intra-cerebrally became somnolent in four days and remained in this condition up to the time of its death, 22 days after the inoculation, although the animal's appetite was maintained it developed a condition of extreme emaciation. Post-mortem examination showed no noteworthy lesion. The brain of this animal was inoculated into another healthy dog, with negative result. This experiment could not, therefore, be regarded as positive. Finally, rabbits were inoculated intra-muscularly with large quantities of brain material, with quite negative results. The disease, therefore, could be differentiated with certainty from rabies, and clinically there was but little similarity between the two affections. The symptoms, existence of incomplete recoveries with persistence of nervous derangement, the lesions, and failure to transmit the affection at a slightly advanced stage, are reminiscent nevertheless of distemper, but the disease could be differentiated inasmuch as dogs of all ages are attacked, nervous symptoms were almost constant, and the typical pustules were not observed on the skin.

REPORTS.

INDIA. **Review of Agricultural Operations in India, 1919-20. Live Stock. Chapter VIII.**—pp. 82-99. 1921. Calcutta: Supt. Govt. Ptg. [Price, Rs. 1-4.]

1. *Prevention and Treatment of Disease.*

Details of the work done by the Civil Veterinary Departments during the year under review are given in tabular form. The large increase in the number of cases treated in hospitals and dispensaries, and by officers on tour, clearly indicates that steady progress has been made in winning the confidence of the agricultural population in the medical treatment of their live stock, an indispensable condition for the success of the work of the department. As a further testimony to this increasing confidence on the part of the general public, it is mentioned that in some provinces, for instance, in Bombay, Madras and the Punjab, private individuals have come forward with offers to establish veterinary hospitals at their own expense.

During the year, rinderpest prevailed in a virulent form in many parts of the country, and was mainly responsible for the rise in the mortality under contagious diseases, the reported numbers of which rose from 2,63,372 in the preceding year to 3,37,396 in the year under review. The number of inoculations made was 7,09,795, but a far greater advance in this direction might have been recorded had it been possible to maintain a regular supply of serum from the Imperial Bacteriological Laboratory at Muktesar.

Although the veterinary staff has been strengthened in some provinces, the resources of the department continue to be inadequate for the proper performance of the heavy and responsible task set before it. In a country in which the bovine population alone exceeds 145,600,000 head, it is idle to expect real progress in combating disease with a comparatively small band of workers, however zealous they may be. The annual loss that the Indian cultivator suffers from preventible diseases of cattle amounts in the aggregate to enormous figures. These losses include not only the market value of the cattle which succumb to disease, but include the set-back to production, growth and vitality, as well as the loss and inconvenience incurred in field operations. In India, as in other countries, where the mainstay of the farmer is his live stock, the necessity for a properly organized veterinary department is one of the very first considerations, and an appeal to figures to prove that the amount of preventible mortality far exceeds the cost of prevention seems scarcely necessary. It cannot be hoped, however, that the present annual expenditure of 352 lakhs on the department in India and Burma, amounting to less than one-half anna per head of bovine population, will go far to provide an adequate organisation.

2. *Incidence of Disease.*

Bombay. The year appears to have been a comparatively healthy one for stock, the recorded number of deaths from contagious diseases being 8,647 against 10,550 in the preceding year. The decrease in the mortality from rinderpest was particularly marked. Lymphangitis in cattle was recorded for the first time in the Presidency, and was found to be prevalent to some extent in the Kanara District. The disease was investigated at the Imperial Bacteriological Laboratory at Muktesar. [See preceding number of this *Bulletin*, p. 22.] Meanwhile, cases are being treated by surgical methods.

Among equines there were 154 reported deaths from surra against 149 in the preceding year. The disease was almost entirely confined to *tonga* lines. Every endeavour was made to instruct the owners of horses as to the nature of the disease, the manner in which it spreads, and the methods of prevention. As a result of the precautionary measures taken, the Chimbur Pinjrapole remained free from the disease for the first time for a number of years.

Madras. The total number of deaths amongst cattle from contagious diseases dropped to 59,297 in 1919–20 from 76,114 of the previous year. There was a decrease under all diseases except anthrax, in which, however, the increase was negligible. Seven cases of surra were confirmed microscopically, but several deaths occurred from the disease amongst the buffaloes belonging to the Forest Department in South Coimbatore Division.

Heavy mortality amongst the sheep and lambs of the agricultural farms at Hagari and Bantanahal in Bellary District occurred during the year and many of the cases showed pneumonic lesions. From the Cattle Quarantine Depôt at Tuticorin, 9,918 cattle were passed for shipment to Ceylon against 4,919 in the preceding year, while at the request of the Colombo authorities, 7,807 animals were inoculated against rinderpest before they were shipped.

Bengal. Contagious diseases were responsible for 14,569 deaths compared with 15,569 in the preceding year. There was a very marked decrease in the death roll under anthrax, the number recorded being 88 only against 2,555 in the previous year. The mortality resulting from rinderpest and haemorrhagic septicaemia was, however, greater than in the preceding year, in spite of the fact that a large number of animals were protected from the ravages of diseases by timely inoculation. A prominent feature of the year was the appointment of veterinary union committees and sub-committees to deal with veterinary matters. Many of the difficulties at present experienced by the Veterinary Department could be easily overcome by a display of energy on the part of such organizations.

Bihar and Orissa. Outbreaks of contagious cattle diseases were on the whole less virulent and more localized in character, the reported number of deaths being 15,781 compared with 25,658 in the previous year. The scheme for inoculation of cattle in Chota Nagpur through the agency of a special staff of locally trained inoculators proved a failure and was abandoned towards the close of the year.

United Provinces. The mortality from contagious diseases rose from 16,233 in the preceding year to 42,715 in the year under review. In spite of vigorous campaigns organized against the disease, rinderpest assumed a virulent form, and levied a toll of no less than 32,572 animals. Surra appeared only in the district of Naini Tal, and 40 animals either succumbed to it or were destroyed under the Glanders and Farcy Act. Seven new hospitals were added during the year, raising the total number to 95.

Punjab. Contagious cattle diseases accounted for 56,089 deaths compared with 28,715 in the preceding year. The increase in mortality was chiefly due to very severe outbreaks of rinderpest, aggravated by the debilitating influence brought on by the last fodder famine and consequent susceptibility of stock to disease. Surra was less widespread than in the previous year, while no cases of dourine were recorded, probably due to the thorough measures adopted by the department against the spread of this disease. The foot bath erected for the stock at Hissar was again successful in diminishing the feet deformities which usually follow untreated cases of foot-and-mouth disease.

Central Provinces. The number of deaths from contagious diseases was 33,052 as against 21,344. Rinderpest was widespread throughout the province and took a virulent form in many districts. Only 81 fatalities from surra were recorded as against 264 in the preceding year.

A new dispensary was started at Warora, bringing the provincial total to 81. More applications were received for the establishment of new dispensaries and are under consideration.

Assam. There was a considerable increase in the number of deaths reported from contagious diseases, the figures rising from 20,819 in 1918–1919 to 39,188 in the year under review. Rinderpest caused 16,242 deaths compared with 7,239 in the preceding year, while deaths from foot-and-mouth disease and haemorrhagic septicaemia were 79 and 93 per cent. more than in the previous year. There was an extensive outbreak of surra in Maulvi-bazar Sub-division of Sylhet District. The disease was also detected in four other districts where, fortunately, it was not so widespread. The unhealthiness of the season emphasized the difficulty of coping with extensive outbreaks of contagious diseases with the existing staff. The question of increasing the number of reserve officers for such contingencies is under consideration.

Burma. Rinderpest caused a heavy death roll, the mortality being more than double the number recorded in the preceding year. The responsibility for the widespread mortality is ascribed to the apathy and neglect of the cattle owners. Foot-and-mouth disease prevailed with varying degrees of intensity throughout the year. Several cases of surra were recorded, including one calf and one dog. The disease was prevalent in the Shan States.

North-West Frontier Province. During the year 30,000 cases of contagious diseases were reported, of which 3,087 proved fatal, as against 31,293 cases and 7,224 deaths in the preceding year. The deaths were mostly due to rinderpest. One hundred and six cases of surra occurred during the year, resulting in 75 deaths.

Sind. The year was a healthy one for stock. Mortality from contagious diseases was low, the total number being 1,688 against 4,125 in the previous year. There was a slight increase in mortality due to surra and glanders.

Baluchistan. The number of reported deaths from contagious diseases was 3,277 as against 6,442 in the preceding year, but the Superintendent, Civil Veterinary Department, in charge of the province, reports that no reliance can be placed on the statistics, and it is certain that many outbreaks of contagious diseases were not reported. Improvement in the control of contagious diseases cannot be reasonably expected until a separate Superintendent for the province is appointed.

Rajputana. The total mortality from contagious diseases was reported to be 252 against 128 in the preceding year. No outbreaks of epizootic diseases were reported from Merwara during the year, but it is very improbable that none occurred.

3. *Preventive Inoculation.*

With regard to some of the contagious diseases, *e.g.*, rinderpest, haemorrhagic septicaemia, and anthrax, it is stated that little can be done in the way of treatment, and from 75 to 99 per cent. of the affected animals are generally lost. A table is given showing the very successful results of preventive inoculation in rinderpest, haemorrhagic septicaemia, anthrax, and blackquarter. In rinderpest, for example, where the normal mortality is 75 per cent., the actual deaths amongst over 680,000 animals inoculated with anti-rinderpest serum amounted to only 0·35 per cent. Complete prevention of rinderpest appears to depend on two things: (1) the provision of a large staff of inoculators;

(2) the co-operation of the people themselves. In one district a bad outbreak of rinderpest was very successfully and speedily controlled through the prompt action of the people themselves in reporting the disease and carrying out the instructions of the Veterinary Department. Vaccination against haemorrhagic septicaemia is steadily increasing in popularity owing to the fact that it reduces the mortality to less than 0·05 per cent., although the mortality among affected animals is as high as 75 to 90 per cent. Requests are now regularly received from certain low-lying tracts liable to the disease to have the cattle vaccinated before the commencement of the rainy season.

Prophylactic measures against anthrax have also been highly successful. Results of injections made, indicate that the mortality among inoculated animals does not exceed 0·22 per cent.

In Madras, where the District Magistrates exercised the powers vested in them, and closed those fairs to which contagious diseases were known to have been imported, it was found that in many instances the people again held unauthorised gatherings of cattle, the result being that diseases could not be got under control as quickly as was expected.

More efficient measures to prevent the spread of disease are undoubtedly required, and legislative measures, in some form or other, restricting movements of diseased cattle from one locality to another, and the compulsory segregation of infected animals, are much needed.

Surra has now been notified as a disease to which the Glanders and Farcy Act applies.

4. *Breeding.*

Cattle Breeding. The heavy decrease in the cattle population in parts of India has naturally caused a good deal of anxiety in certain quarters. Epizootics of disease and fodder famines are no doubt the two main causes of the decrease. It is stated that cattle rearing, in spite of the high prices of draught animals, is still less profitable than crop-growing.

The efforts of the Veterinary Department to improve the working cattle are now being supplemented by the work of the Agricultural Department in breeding higher milk-yielding cows.

Sheep Breeding. Although there are several difficulties in the way of improving the Indian sheep, they are by no means insurmountable; thus, while experiments in progress at Bantanahal in Madras, like those in some of the other Provinces, have met with but little success, the attempts made in the United Provinces, the Punjab and the North-West Frontier Province, continue to give increasingly promising results.

A summary is given in which are outlined the programmes of the various Provinces.

5. *Veterinary Education.*

For the training of students in veterinary science, there are colleges provided at Bombay, Madras, Calcutta and Lahore, and schools at Insein and Taunggyi in Burma. The colleges at Bombay, Madras and Calcutta continued to give a three-year diploma course in English, while the one at Lahore held a similar diploma course in the vernacular.

It is proposed to give a revised course at the Lahore college, involving four years instruction in English, and this will be brought into force as soon as the necessary arrangements have been made. Meanwhile the four years' vernacular course, as at present conducted, has been definitely abandoned. The total number of students who passed the final examinations of the colleges during the year was 153, as against 142 in the preceding year.

The scheme for establishing a veterinary college for the United Provinces, which has been delayed owing to the war and other reasons, is now receiving the attention of Government. It is hoped that building operations will shortly be started at Lucknow, where a site has already been selected.

For post-graduate training, a revised course of instruction has been drawn up for the Lahore veterinary college, and will be instituted in due course, while proposals for the institution of similar training at the Madras veterinary college and in the veterinary research laboratory at Nagpur, are under consideration.

The veterinary schools at Insein and Taunggyi give vernacular courses of three years and a year and a half respectively. Although these schools are attracting candidates in larger numbers, they do not fully meet the requirements of Burma, and provision will shortly have to be made for higher veterinary education, with a view to the training of Deputy Superintendents in the Province.

For educating the public in veterinary matters, leaflets dealing with prevention and treatment of cattle diseases were freely distributed, and lectures on animal diseases, cattle breeding, etc., given to cultivators and stock owners congregated at fairs and shows.

6. *Veterinary Research.*

As mentioned in the previous reviews, depletion of staff and increased routine and administrative duties have greatly curtailed opportunities for research work, the greater part of which was carried out at the Imperial Bacteriological Laboratory, Muktesar, and related to the following subjects :—

Rinderpest and Haemorrhagic Septicaemia. The experiments in progress during the year 1918–1919 regarding infectivity of hides of animals that had died of these diseases were continued during the year under report.

Johne's disease. A herd infected with this disease in Bihar was tested with avian tuberculin. As it was impossible to obtain permission to kill any of the reacting animals, the value of the test could not be determined.

Tuberculosis. The inoculation experiments foreshadowed in last year's report have been completed. [See this *Bulletin,* 1920, Vol 8, No. 3, p. 227.]

Bovine lymphangitis. With material received from the Madras Presidency experimental work was carried out, and the causal organism was isolated. [See this *Bulletin,* preceding number, p. 22.]

Surra. On the recommendation of the Surra Committee, an experiment was initiated at the Muktesar laboratory to ascertain the effects on different animals of the inoculation of strains of the *Trypanosoma evansi* derived from other species. Experiments in curative drug treatment were also carried out. Detailed reports by the Camel Specialist (Cross, H. E.) on the course that surra runs in camels, when naturally contracted and when artificially inoculated, and on the course that camel surra runs in ponies, buffaloes, and other animals, are under publication [see page 58]. Further experiments in the drug treatment of surra are being carried out by the Camel Specialist. The Imperial Pathological Entomologist continued his work on surra and carried out a fly survey in the Punjab and the North-West Frontier Province.

In the United Provinces, the research and experimental station at Badshahbag continued to fulfil a useful purpose in affording opportunity to the staff for observation and study of disease and methods of research. Some inquiries have been carried out in regard to cattle tuberculosis, spirochaetosis in fowls, and *kamri*. Investigations regarding the most economical and effective form of drug treatment for the numerous internal and external parasites of sheep and cattle, as well as the prophylactic and curative effects of various vaccines, have also been carried on.

UGANDA PROTECTORATE. **Annual Report, Department of Agriculture, for the Year ended 31st March, 1920.—Report of the Acting Chief Veterinary Officer** [RICHARDSON (U. F.)]. pp. 35–40. F'cap. 1921. Entebbe: Govt. Ptr.

Rinderpest. As usual, the chief feature in the Uganda Report is the account given of rinderpest. This disease had swept through the Buganda Province during the preceding year, and appeared in the Toro and Ankole districts of the Western Province in the early months of 1919. Owing to the rapid spread of the disease, shortage of staff, and difficulty of getting serum quickly to the districts, effective work could not be commenced until the end of March, 1919, and when the year began rinderpest existed just west of Mbarara in Ankole, was widespread in the Masaka district of Buganda, and was fairly prevalent in the south-eastern corner of the Toro district.

In the Buganda Province a few scattered outbreaks occurred in Kiagwe County of the Mengo district, but these outbreaks were stamped out and no serious loss occurred. In the Masaka district only small groups of cattle had escaped the disease, which had been devastating this district since December, 1918, These groups were immunised with serum as far as possible. During the outbreak 40,000 out of 52,000 cattle are reported to have been lost in this district.

Western Province. Rinderpest had appeared in Eastern Ankole in January, 1919, and by the end of March, 1919, it had swept through the eastern half of the district and appeared to the west of Mbarara. The disease, however, was quickly got under control, thanks to the efforts of the officers, and an attempt was made to create an immune belt of cattle, immediately to the west of Mbarara, by drawing the cattle from this area eastwards, immunising them, and then returning them to their grazing grounds. By the beginning of November this belt appeared to have been completed and rinderpest had not broken out to the west of it. Towards the end of December, however, it was found that the disease existed in the County of Kazara, west of this belt, where cattle were extremely numerous, and owing to the difficulties with the native population, the disease spread and appeared in the neighbouring Belgian territory, and in March, 1920, in the Ruzumburu County of the Kigezi district.

In September, 1919, game were reported to be dying on the southern shore of Lake Edward in the Kigezi district; the country along the shore of this lake is uninhabited, and infested with buffalo and other game. Hunting parties were introduced in order to prevent the infected game breaking west or south. The object was partly attained in that the game were kept out of inhabited areas which are very rich in stock. However, the game did break westwards, and infection was thereby spread to the Ishasha Valley and the Congo Territory. The disease broke out in cattle in the Kigezi district in March, 1920, having probably been introduced from Ankole. It was hoped that a large proportion of the cattle in this district would be saved.

In the Toro district the disease broke out in January, 1919, but measures taken prevented the spread of the disease, except through the southern part of the district, then infested with enormous numbers of buffalo. The main quarantine line was established along the Kampala—Fort Portal main road, and the disease never spread to the cattle areas north of that line. As many as possible of the cattle south of the line were immunised, but owing to shortage of staff only a small proportion of this work could be accomplished.

Eastern Province. Small outbreaks continued throughout the year in all the districts of this Province, but little work could be done in combating the disease.

Rinderpest Inoculation.—During the year the number of cattle inoculated with serum and virulent blood was as follows:—Buganda Province, 1,638 adults (with 12·5 per cent. mortality) and 220 calves; in the Toro district, 3,727 adults (with 20 per cent. mortality) and 780 calves; Ankole district, 30,393 adults (with 11·9 per cent. mortality); Eastern Province, 1,662 adults (mortality unknown) and 98 calves. The losses in calves were about 60 per cent.

In adults, the high average mortality in Toro was chiefly due to complications with trypanosomiasis. In Ankole, losses varied greatly in different inoculation centres, and they would have been much less but for complications with trypanosomiasis and redwater. 275 cattle were re-inoculated to test their immunity, but did not react to the second inoculation.

Pleuro-pneumonia. This disease appeared in all probability first in Kitgum in January, 1919, and a definite report of its existence in Karamoja was received in November,1919, where it is estimated to have caused the loss of from 50-60 per cent. of cattle in the district. In December the disease was found to exist in Teso and Busoga districts, and was suspected in Bukedi. Temporary measures appeared to have been successful in preventing further spread, pending the arrival of a proper staff for dealing with it.

Trypanosomiasis. This disease was encountered in almost every district in which work was being carried on. In Ankole losses were reported to be heavy, apparently due mainly to the movement of cattle into tsetse areas with a view to avoiding rinderpest, and bringing the remnants of herds into contact with other remnants which had suffered from rinderpest. In Toro many cases were encountered in inoculation camps, but isolation measures averted a serious epizootic. In Buganda two transport herds working from Mityana to Kampala were completely exterminated. These animals had been working for over four years with only very small losses, and they have now been replaced with fresh cattle which have been working satisfactorily and over the same roads for months.

In Busoga and Tango, extension of old tsetse areas is believed to have occurred leading to the infection of cattle along their borders. In Kampala no cases have occurred since dipping has been commenced regularly in July. This is said to be remarkable in view of the regular incidence of the disease which usually occurs. Of the cases under treatment in Kampala during the year, 23 were dismissed as cured, 8 died, and 7 were slaughtered as they failed to respond to treatment. No cases of relapse after cure were encountered. The mortality in untreated animals was apparently 100 per cent.

Foot-and-mouth disease. One outbreak was encountered in Ankole in cattle brought in for inoculation against rinderpest.

Tuberculosis. No further cases came under observation during the year.

Anthrax. One outbreak in Ankole.

Biting flies. Stomoxys were extremely numerous in the months of January, and June in Mengo district, and large numbers of cattle are believed to have died owing to worry caused by these flies. Owners who adopted the plan of keeping cattle in huts during the day, and grazing them at night, reported a cessation of deaths and marked improvement in the condition of their cattle. Measures taken for preventing mortality among transport cattle are explained, and the work during the year, it is stated, tends to show that with proper supervision and with veterinary assistance available, the danger from trypanosomiasis, which has been the chief cause of loss to working cattle, can be successfully combated.

The Kampala dip was re-started in June, 1919, and used regularly throughout the rest of the year. There was an immediate cessation of trypanosomiasis in dipped herds, although cases continued to occur in two undipped herds and the dipping effected a marked improvement of cattle in the township. Losses among calves also ceased. Dipping was performed on Wednesday and Saturday of each week, using the laboratory dip of three days' strength. Calves were not dipped until they were two months old. The owners state that calves contract East Coast fever in a mild form, but further work requires to be done in order to ascertain the degree of immunity acquired by the young stock.

Diseases in animals other than cattle. Two cases of ulcerative lymphangitis in mules were treated. No cases of epizootic lymphangitis came under observation. The Protectorate, however, was practically denuded of ponies and mules during the War. No serious outbreaks of disease occured in sheep and goats. Mange was seen in goats in Busoga. In dogs cases of piroplasmosis were treated, but there were a very large number of relapses, and in one case, trypanblue had to be injected four times before a cure was attained. A disease resembling rabies was reported in Ankole, but no cases came under observation and apparently it rapidly died out. Several cases of infection of dogs with filaria came under observation and the disease was very fatal. Fowl diphtheria was very prevalent in June and July, 1919, and several outbreaks of fowl cholera occurred in Kampala later in the year. A few cases of tuberculosis were also encountered in fowls. The report concludes with the returns of the Kampala slaughterhouse and other miscellaneous information.

TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY BULLETIN.

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DISEASES DUE TO PROTOZOAN PARASITES.

NATTAN-LARRIER (L.). **Essais de transmission héréditaire de la Dourine.** [Attempts at the Hereditary Transmission of Dourine.] —*Bull. Soc. Path. Exot.* 1921. May 11. Vol. 14. No. 5. pp. 273–277.*

The trypanosome of dourine is known to have the power of traversing mucous membranes with ease. It was consequently decided to ascertain whether in any circumstances it could traverse the placenta in pregnant females.

In mares, infection with *T. equiperdum* frequently produces abortion, but this phenomenon was not observed in any pregnant female rats or mice used as reservoirs during the author's experiments.

In the course of these experiments female rats and mice were inoculated intraperitoneally with *T. equiperdum,* and periodic subsequent blood examination showed them to be infected. The young from such mothers were observed carefully and blood smears were examined, but in every case with negative findings. Further experiments are quoted in which emulsions of triturated organs—spleen and liver—and blood from such young rats and mice were injected intraperitoneally into other rats and mice. In no case did a trypanosome infection follow. Incidentally it might be noted that although there is no hereditary transmission of trypanosome infection, it is nevertheless quite common for one or more foetuses of a litter to be born dead. Also trypanosomiasis was never seen to develop subsequently in young born of an infected mother.

It might be suggested that they were born with some degree of immunity, but this was disproved by inoculating such young with virulent blood; in all cases they developed and succumbed to *T. equiperdum* infection. Furthermore, it was similarly proved that no immunity was developed in virtue of sucking an infected female—the milk confers no immunity.

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* Abstracted by Mr. S. C. J. Bennett, B.Sc., M.R.C.V.S.

MARSHALL (Claude H.). **A New Method of Treatment of Trypanosomiasis.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1921. Mar. 18 & May 20. Vol. 15. Nos. 1 & 2. pp. 10–34.

In this paper Marshall describes "a new method of treatment" of human trypanosomiasis originated by himself and VASSALLO (S. M.) of the Uganda Medical Service.*

In the treatment of human sleeping sickness experience shows that one dose of salvarsan, neosalvarsan, or atoxyl is sufficient to sterilize the blood stream, but within a variable period the symptoms reappear and the disease progresses to a fatal termination. The relapse would appear to be due either to the possibility that (1) the trypanosome assumes a resistant form and becomes atoxyl-" fast," or (2) some of the parasites are protected from the action of the drug by assuming a secluded position in the central nervous system. The author quotes four cases which would appear to lend support to the latter assumption; living trypanosomes were discoverable in the cerebro-spinal fluid in these cases after sterilization of the blood stream and lymphatic glands. It was further claimed that in fatal cases the meninges of the brain were greatly thickened, due, it would appear, to the action of the trypanosome in the central nervous system. This thickening of the membranes would cause the connection between the blood stream and cerebro-spinal fluid through the choroid plexus to be occluded quite early in the disease, so that drugs circulating in the blood stream could not enter the spinal fluid to act upon the trypanosomes therein. The parasites would subsequently be able to reinfect the blood stream. Before the cerebro-spinal fluid has been invaded it is quite feasible that injections of arsenic and other drugs are capable of curing the patient, but once the central nervous system is invaded intravenous medication is useless except to deal with such parasites as subsequently reappear in the blood stream from the lymphatic system.

In pursuance of this hypothesis the author in 1918 attempted treatment by injection of neokharsivan intravenously, and three days later a minute dose of the drug was injected into the spinal canal. The patient, however, died on the following day. As this form of treatment had failed, the next case was given an intravenous injection of the drug, and three hours later 2 oz. of blood were withdrawn and allowed to clot. Twenty minims of clear serum were then injected into the spinal canal after a corresponding amount of spinal fluid had been drawn off by lumbar puncture. The case (a woman) was one of well-marked sleeping sickness, with typical enlarged cervical glands. Blood was examined at intervals of three months, and 27 months after treatment the patient was quite well; the blood and cerebro-spinal fluid were then negative, and the swelling of the neck glands had completely disappeared soon after the injection and had not reappeared. In all, 54 cases were treated in this manner, and of these, 31 had undergone treatment over six months previously. One of these died under chloroform. Of the 30 cases that had been treated with serum once only 22 cases still remained alive and well, *i.e.*, 73 per cent. Thirteen of these cases had undergone treatment over a year previously and nine of these (69 per cent.) were still alive and well. One dog infected with *T. gambiense* was treated as a control to see if an intravenous injection of neokharsivan can alone cure the disease, but the animal had to be shot about a month later as it was hopelessly ill. All the cases said to have been cured were examined in December 1920, and the blood and cerebro-spinal fluid gave negative results on examination in all of them. After treatment the glandular swellings also invariably disappeared completely. Of the six patients who died two disappeared during a period of famine, and one of these is stated to have died of starvation; two died of intercurrent disease, and two apparently died of sleeping sickness; these were very advanced cases of the disease. Thus one case remained quite well for over 27 months, another for 24 months, and seven for over a year after treatment with a single dose of serum.

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* Dr. Andrew BALFOUR suggested in 1909 the intrathecal injection of immune serum. [*Sleeping Sickness Bulletin*, Vol. 1, p. 163.]

It would appear that the beneficial results were attributable to the action of a trypanolytic antibody normally found in the blood during the reaction to the parasitic invasion. It is not feasible that the minute quantity of the drug held in the small quantity of serum injected into the spinal canal would be powerful enough to kill off the trypanosomes. In support of this view it is stated that in several cases the patient received no intravenous injection, but simply a dose of serum expressed from blood that had been drawn off for as long as three days. The first case treated, when examined six months later, appeared to have gone on well, and no trypanosomes were discoverable in his blood or spinal fluid. VASSALLO is now trying the effect of intra-spinal injection of serum from a previously treated case.

One European exhibited at the meeting showed signs of the disease on July 30, 1920, and when examined a month later his blood was found to be swarming with trypanosomes. He was given 0·9 gm. of neokharsivan intravenously and 12 cc. of serum into the spinal canal. He showed a very severe reaction for several days and then made an uninterrupted recovery. However, six weeks after the serum injection, while nothing abnormal could be found in the blood, sub-inoculation into two rats and a monkey resulted in one rat showing trypanosomes 28 days later. The monkey became very sick, but it did not die, and no trypanosomes were found in its blood. Again, 21 days later a careful search showed only one degenerated trypanosome in the blood. Sub-inoculations into guinea pigs were negative. The author considers that the presence of such degenerated trypanosomes was merely a feature of the normal process of cure by this method. Thirty days later the cerebro-spinal fluid was examined by staining and inoculation into rats and mice, with negative results. The presumed cure of this patient would therefore not be due to the trypanocidal action of the initial dose of the drug, inasmuch as trypanosomes could be discovered in the blood after treatment. Subsequently this patient showed an excellent clinical history, and examination of the blood failed to disclose any trypanosomes. The injection into the spinal canal would therefore probably have dealt with that focus of infection, while the continued formation of trypanolysins in the blood gradually destroyed the parasites in the blood stream.

The two most advanced cases did not prove amenable to treatment, and in advanced cases no cerebro-spinal fluid could be obtained by lumbar puncture. It would seem that this condition was due to the thickening of the membranes, resulting in occlusion of the foramen of Majendie. If the authors' theories are correct there appears to be no reason why animal serum should not be used for treatment, and it is suggested that the line of treatment might well be applied to animals. Further work is being carried on by VASSALLO and the author on these questions. "The problem of trypanosome infection is the same whether applied to human beings or other animals, and experiments on the treatment of each dovetail into one another, so that the co-operation of a veterinary officer in future work is extremely desirable."

In the discussion which followed, HALLIBURTON (W. D.) gave a succinct account of what he regarded as the normal formation of the cerebro-spinal fluid and its normal function. The cerebro-spinal fluid, it was stated, is a secretion, not a leakage fluid like lymph is from the ordinary blood stream. The choroid plexus, which MOTT has called the choroid gland, plays a part which is something analogous to that of a secreting gland such as the salivary gland, but in this case the blood vessels are inside and are coated over by cubical cells which are true secreting cells and show histological changes similar to those which can be detected in various stages of secretion in the salivary glands. The blood leaks from the capillaries and gives rise to lymph, and then the cells take up from the lymph the materials which they want and pour their secretion into the cerebro-spinal spaces. This secretion, as with other secretions, is of constant composition, for otherwise any error in composition would produce serious effects upon the very sensitive nerve cells. Thus the cells which secrete the fluid form a barrier to prevent harmful materials entering the cerebro-spinal fluid. There are only one or two very volatile materials which are capable of traversing the choroid cells, and of these alcohol is one, but metallic poisons are kept back even in disease. Therefore the only method of attacking parasites, such as the spirochaete of syphilis or the trypanosome of sleeping sickness, which have gained access to the spinal canal is to inject the drug employed not into the blood stream, but directly into the cerebro-spinal fluid. However, drugs injected in this manner produce severe effects upon the very sensitive nerve cells, but in the method described by Marshall and VASSALLO the material injected appears to be fatal to the parasite but not fatal to the host.

HALLIBURTON thus discredits the authors' hypothesis that the action of the trypanosome in the central nervous system is to cause such thickening of the membranes that connection between the blood stream and cerebro-spinal fluid through the choroid plexus is occluded quite early in the disease. The choroidal cells, in fact, remain quite healthy. Materials introduced artificially into the cerebro-spinal canal do not leave by the lymph channels, for if methylene blue, for example, is introduced into the spinal canal, no trace of blue passes into the lymph stream. The fluid, which is being continually formed, does not find an exit by the nerve or other lymphatics, but through the microscopic arachnoid villi, which project into the venous sinuses mainly at the base of the brain. A few seconds, therefore, after the injection of methylene blue, although it cannot be discovered in the lymph, it can be found in the blood, and in a few minutes in the urine. Communication is not via the lymph stream, but by the blood stream and the arachnoid villi.

The method of treatment was criticized adversely by MANSON-BAHR (P.) and LOW (G. C.). MANSON-BAHR doubted whether invasion of the cerebro-spinal fluid by trypanosomes was necessary in order to produce the sleeping sickness state; he mentioned a case under his care in which the cerebro-spinal fluid had consistently given negative results on testing and was then in a dying state, five years after the original infection. Another case had received Marshall's treatment, without success. There were on record about 16 cases in Europeans of undoubted recoveries from *T. gambiense* infection. The idea that the trypanosomes are only present in the cerebro-spinal fluid in sleeping sickness is begging the question, according to Low. Moreover, there is no proof that the antibody cannot get into the cerebro-spinal fluid. In syphilitic conditions such as general paralysis of the insane and locomotor ataxy a similar theory to Dr. Marshall's had already been put forward, but salvarsanized serum injected into the spinal canal and even into the lateral ventricles produced absolutely negative results.

The meeting, however, unanimously decided to give the workers every encouragement to obtain means for exploiting their method of treatment.

CROVERI. *Trypanosoma theileri,* **varietas** *somalensis,* **chez les bovidés somaliens, considéré par rapport à la peste bovine et aux séro-vaccinations anti-pesteuses.** [*Trypanosoma theileri* var. *somalensis* in Somaliland Cattle considered in Relation to Rinderpest and Anti-Rinderpest Vaccination.]—*Rev. Path. Comp.* 1920. July. Vol. 20. No. 170. p. 183.

Croverie describes a trypanosome in the blood of cattle in Italian Somaliland which would appear to belong to the type *T. theileri* according to its general characteristics, but the constant presence of a few secondary characteristics would seem sufficient to authorize the creation of a new variety to include this trypanosome. The trypanosome possesses extreme motility, length 40–70μ, breadth 3–7μ, markedly pointed extremities, cytoplasm staining irregularly of a deep blue colour, generally granular towards the posterior extremity; nucleus usually rounded, stained chromatin red, placed in the centre of the body where it does not stretch across the whole breadth; nucleolus fairly large, well stained, and placed at some distance from the posterior extremity, between this extremity and the nucleus; flagellum long and well stained, united to the protoplasmic body by means of a well-developed undulating membrane; common occurrence of degenerated forms. Contrary to what is observed in the pathogenic trypanosomes, this variety is never seen in the lymphatic glands. The trypanosome is observed quite commonly in healthy cattle used for the manufacture of rinderpest vaccine. It shows no virulence, but it would seem that it becomes pathogenic during the course of rinderpest infection and modifies appreciably the characters of the disease. The important question was raised, what would be the ultimate action of the parasite upon the properties of the serum or vaccine. According to the author it appears to have no influence.

MESNIL (F.). **Variété des voies d'accès des parasites sanguicoles à leurs hôtes.** [The Different Modes by means of which Blood Parasites enter into their Hosts.]—*Bull. Soc. Path. Exot.* 1921. June 8. Vol. 14. No. 6. pp. 310–315.

The optimum method of transmission for a blood parasite is brought about when it is withdrawn from the blood by an insect and is reintroduced by it into suitable blood. Leaving aside the cases where the insect plays but a mechanical rôle in much the same manner as a syringe needle, cases of trypanosome transmission by means of tsetse fly take first consideration. In the very simple case of

T. cazalboui development takes place only in the proboscis, while with *T. brucei* and *T. gambiense* the development leaves the proboscis and is continued in the stomach and then in the salivary glands, to return again to the proboscis; the development of *T. dimorphon* [*congolnsce*] is intermediate in character, this trypanosome returning to the proboscis after development in the stomach. In all these cases, however, the development has certain points in common: (1) the flagellate after leaving the blood passes through a crithidial stage and again returns into a particular trypanosome form ,called the "metacyclic form" by BRUMPT, and in this form it can be reinoculated into the vertebrate host, and (2) the same physiological fluid, the saliva, plays a capital part in all the cases.

The malarial parasites of man display the same kind of adaptability, complicated on account of the different zoological position of the parasites. After having been taken from human blood in the form of gametocytes the parasite undergoes a complete sporogonous sexual development in the mosquito, resulting in the formation of sporozoites, which pass into the salivary glands and thence can be reinoculated into man. The same phenomena appear to occur in the different spirochaetoses and their tick vectors, typhus and the louse, and yellow fever and Stegomyia.

In what may be called a second type of transmission the parasite, after withdrawal from the vertebrate blood, is not reintroduced into this medium. On the other hand, it is transported by the insect at the moment of biting, but only on to the surface of the skin. The example of the filarial parasites is interesting in this respect. The microfilariae (*bancrofti* of man and *immitis* of the dog) taken up with the blood develop in the mosquito up to a certain stage and then, after becoming liberated in the body cavity, they are directed into the lower lip of the mosquito, which appears to be a sort of predilection seat for them, and they accumulate in this situation. The lower lip, however, does not form part of the proboscis, but is a sort of gutter-like sheath which becomes curved into U-shaped form when the stylets of the proboscis penetrate the skin, and the extremities of this lip (the labellae) are applied to the skin. The lower lip therefore constitutes a closed path for the filariae, but after having been thrown forward at the time when the lip is curved they are dashed against a thin membrane (the so-called Dutton's membrane), situated between the two labellae. They rupture this membrane, and are thus found at the surface of the skin. FULLEBORN showed that the young filariae crawl about on the skin and are capable of traversing healthy skin in the same manner as the Ankylostoma or Anguillula larvae, especially when the skin is moist, and thus infect a new individual.

With some other parasites development and concentration takes place not in the anterior part of the insect's body, but in the posterior portion of the intestine, and the parasites are eliminated with the excreta—examples, fleas and the human plague organism, fleas and the rat trypanosome (*T. lewisi*), and Hemiptera of the genus *Triatoma* and *Schizotrypanum cruzi*, the causal organism of Chagas's disease in the human subject. These insects defaecate frequently in the course of their blood-sucking operations, which last a considerable time. The parasites from the rectum are thus deposited on the surface of the skin, and in a certain number of cases at least they seem to be capable of traversing it, perhaps through the breaches in continuity determined either by the insect bite or by scratching. In other cases this penetration can only be accomplished when the virus is transported on to the surface of mucous membranes, as would appear to take place in Chagas's disease. Here return of the parasite to the salivary glands would appear to be accidental, and the normal mode of inoculation would seem to be by the passage of the metacyclic trypanosome developed in the rectum of the bug through the mucous membranes. During the night it is known that these insects crawl over the faces of sleepers and are thus capable of infecting the facial mucous membranes.

It was formerly held that the louse acted as transmitter of the spirochaetes of relapsing fever, but it was found impossible to transmit the disease by means of its bites. NICOLLE (Ch.) and his colleagues found that the virus became established rapidly in the body cavity of the louse and remained bottled up in this situation. Neither the anterior nor posterior part of the digestive tract disclosed parasites, and in order to account for the transmission of the spirochaete from the louse to man, NICOLLE suggested, as the only possibility, that the louse was crushed on the body surface, and this liberated the spirochaetes and enabled them, therefore, to traverse the skin through scratches or the mucous membranes.

In a third class the blood parasite enters the vertebrate host via the digestive tract, and the first example of this kind was that of the Leucocytozoon of the rat. The life-cycle of this protozoon was completely traced by MILLER in 1909. The haemogregarine parasite inhabited the rat leucocytes, and accomplished its sporogonous development in a small acarus commonly found on rats, *Loelaps echidninus*. The sporozoites developed, however, were not liberated from the ripe spores, and the rat became infected only after eating the acari.

The development of the rat trypanosome in the rat flea has been carefully studied by MINCHIN and THOMSON, but STRICKLAND has also shown that the rat may become infected by eating infected fleas. Subsequently NÖLLER and WENYON suggested that rats became infected chiefly by licking the faeces deposited by the fleas on their skin—a mode of infection that would approach that which was discussed under the second class of transmission. It remains to be seen which is the more important natural form of transmission.

The examples of the rat leucocytozoon and *T. lewisi* represent, it would seem, a transition towards what is seen in the case of certain Coccidia which have dual hosts, as, for example, the coccidian parasite which undergoes its sexual reproduction and sporogony within certain Cephalopod hosts (octopuses and cuttlefish) and undergoes schizogony in crabs. The Cephalopod host becomes infected by eating the crab and the crab becomes infected by ingesting spores from the Cephalopod (LEGER and DUBOSCQ).

Passing by other examples such as those of the piroplasms, which are complicated by hereditary infection in the invertebrate, the importance of the mode of entry upon the subsequent development of the parasite may be illustrated by another example, viz., that of *Stephanurus dentatus* of the pig, which is not a blood parasite. In much the same way as ankylostome and anguillulid worms it is capable of penetration via the skin as well as by the mouth. BERNARD and BAUCHE found that the seat of the parasite in the pig and the disease provoked differed according to the port of entry. If penetration took place through the skin the parasites became established around the kidneys and ureters and a chronic disease was set up, with rapid excretion of worm eggs. If, on the other hand, infection took place by way of the mouth, the parasites became established in the liver and caused a severe type of disease with cirrhosis of the liver, and the eggs could not be eliminated. In Annam, French Indo-China, the first-named type of the disease is by far the most frequent, indicating that the common mode of infection is through the skin.

Mesnil then briefly discusses the subject of insect transmission from an historical and from a phylogenetic point of view. Historically he traces our conceptions of this phenomenon from the time of MANSON's discovery in 1877 of the development of the filaria in the mosquito, and the discovery by LOW and JAMES of the true method of transmission of this parasite. Following upon the lead given by MANSON's researches, ROSS was inspired to work out the development of the malarial parasite in the mosquito and discovered the important fact that it was the mosquito that transported the parasite back into the blood. Meanwhile LOOSS's researches on intestinal parasites, such as ankylostomes, anguillulas, also accustomed us to this method of active cutaneous penetration. But the more recent researches of LEIPER have shown that one would be in error to generalize too readily, for the guinea-worm, which, moreover, is not an intestinal parasite, is absorbed via the mouth with a second host—a small copepod crustacean.

Having in mind the examples of various viruses, such as those of yellow fever, typhus, etc., the notion that blood parasites were reinoculated by the bite of the insect was also a little quickly generalized. MILLER's discovery perhaps did not attract sufficient attention. It was surprising to learn that all trypanosomes were not inoculated by the proboscis of the invertebrate, and this new notion subsequently had to be extended to other diseases such as relapsing fever.

From a phylogenetic point of view it is interesting to study, for example, the origin of the blood trypanosomes. Inasmuch as most of them are parasitic in both vertebrate and invertebrate, it would be of value to ascertain the primitive host. The theory first emitted was that of LOUIS LÉGER, which has since been upheld by several French writers, and is based upon the observation that in insects, both biting and non-biting, several representatives of the large family *Trypanosomidae*, and in particular the types *Leptomonas* and *Crithidia*, which are discoverable in the life-cycle of the trypanosome, are to be found. It would therefore appear that the invertebrate is the primitive host. According to MINCHIN, on the contrary, the vertebrate host would be accountable and, moreover, the trypanosomes might be derived from intestinal forms. When this theory was propounded the only types of intestinal trypanosomes known were comparable to the blood flagellates or so-called trypanoplasms of fishes, which are markedly different from the ordinary pathogenic trypanosomes.

Mesnil believes that recently recorded facts bearing upon the entrance of certain trypanosomes by way of the digestive tract of the vertebrate lend strong support to MINCHIN's hypothesis. This channel of entry is regarded as imperfect in comparison with inoculation into the blood stream, a view which makes it reasonable to conclude that it is the more primitive method. Moreover, there have been found in the intestinal tract of a number of invertebrates flagellates known as Leptomonas, which are precisely ancestral forms of trypanosomes. It is also known that these Leptomonas, together with other flagellates which normally inhabit the intestine, are capable of passing into the blood stream, and the frequency with which these transmissions have been recorded during the last few years tends towards the belief that the phenomenon is applicable not only to pathological processes.

Further, it may be therefore said that if one desires to undertake a classification of the genus *Trypanosoma* by dismembering it, for example, into sub-genera, one must above all else base this division upon morphological characters. In this way one is forcibly struck with the parallelism existing between the grouping of the trypanosome species and the subdivision of vertebrates into classes. It is therefore easy to conceive a sub-genus for the fish trypanosomes, another for the trypanosomes of lizards and reptiles, another for avian trypanosomes, two at least for mammalian trypanosomes (one for the so-called non-pathogenic *lewisi* type, and another for the *brucei, gambiense,* etc., types) without counting the trypanosomes of the *Schizotrypanum* type. Thus in the same class of vertebrates, in spite of the common appearance of the infesting trypanosomes the vectors may belong to quite different classes of invertebrates. It is difficult to imagine that there simply lies therein nothing but convergence. It is agreed that no argument is entirely convincing, but the sum total of them all tends to incline one more and more towards the view that the vertebrate is the primitive host.

SERGENT (Etienne & Edmond). **Étude éxpérimentale du Paludisme. Paludisme des Oiseaux** (*Plasmodium relictum*). [Experimental Study on Malaria—Bird Malaria (*P. relictum*).]—*Bull. Soc. Path. Exot.* 1921. Feb. 9. Vol. 14. No. 2. pp. 72–77.*

These experiments were designed with a view to estimating the value of quinine as a preventive or curative of malaria. It was obviously impossible to carry out the tests on the human subject, so that bird malaria was chosen owing to the close relation of the two malarial parasites. Canaries bred in captivity in insect-proof cages were selected as the most convenient and plentiful subjects for experiment. These birds are very susceptible to *Plasmodium relictum* infection in that an intraperitoneal dose of one drop of infected blood will within from three to ten days produce a blood infection with very numerous parasites (80 parasites per field of the oil-immersion objective in an ordinary blood smear). Death is produced in about 30 per cent. of cases.

A preliminary experiment showed that quinine hydrochloride was of curative value, as a quantity of 0,003 gm., divided into three doses, given on the first day the parasites appeared in the blood caused them to disappear within 48 hours, whilst in control birds the infection remained intense for another five days.

To determine the prophylactic value of quinine, birds were inoculated with virulent blood and simultaneously with 0·7 milligrammes of hydrochloride of quinine subcutaneously, a similar dose being given daily afterwards. No symptoms were presented and no parasites appeared in the blood so long as the daily dose of quinine was injected, while the control birds all developed typical symptoms with blood invasion. It was found necessary to give the dose of quinine every day for at least a month, but after this period every second day was sufficient. In many cases, even after prolonged treatment with quinine, a bird which had throughout shown no symptoms would become ill as soon as dosing with quinine was discontinued. The parasites must thus remain latent in the body,—a fact which was proved by the infectiousness of the blood of such birds for clean controls.

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Additional doses of virulent blood were found to be harmless to birds receiving quinine treatment.

One may conclude from the above that prophylactic doses of quinine will at least ensure the survival of subjects exposed to infection and—a most important feature if it be applicable to human malaria—the acute phase of the disease will be eliminated.

Further experiments proved that other methods of dosing with quinine are useless. A single large dose given either before, at the time of, or soon after the virulent inoculation did not in any case inhibit acute symptoms, although a single large dose given within 24 hours of inoculation delayed the appearance of symptoms by from two to four days. Furthermore, repeated small daily doses are of no value if discontinued after a short while.

The authors conclude that quinine dosage given beforehand in anticipation of infection is useless, as are also a few doses, even if of considerable size, given after infection. The only system whereby the acute stage and symptoms may be suppressed is to give daily small doses uninterruptedly after the subject has been exposed to infection. [No mention of any time limit is made.—S.C.J.B.]

The quinine treatment is not only of value to the subject so treated, but is beneficial to others in that the virulence of the malarial parasite is diminished. This was proved by taking 18 canaries, 8 of which were treated with quinine and 10 not treated after virulent inoculation. The infectivity of the blood of all these birds was tested on mosquitoes, and other birds at intervals of one, two, four and six months. Of the eight birds treated with quinine two were non-infective, while the blood from the six others produced a mild infection in test subjects, the virulence only being restored to the normal after two or three passages. In the case of the control birds, even though they survived and showed no symptoms, the virulence of the parasites in their blood was up to the normal standard.

A single case is quoted of a sudden resistance to quinine on the part of a parasite in a treated bird. This bird had been infected with *Plasmodium relictum* and had been receiving daily doses of quinine for a period of nine months, showing no symptoms meanwhile. Suddenly parasites appeared in the blood and remained in spite of quinine treatment. Blood from this bird was virulent for other birds, which developed acute symptoms in spite of quinine treatment. After two passages, however, the parasite resumed its normal character and susceptibility to quinine.

Many other drugs were employed in similar experiments, but none of them gave evidence of possessing any curative or preventive qualities; they were marrubium, salicine, colloidal sulphur, emetin, arsenobenzol, cinnamon essence.

Vaccination experiments were attempted on a large scale, tests being performed on the following lines :—

1. Unnatural mode of infection—injection of virulent blood per rectum and intracutaneous inoculation of glands containing sporozoites.
2. Attempted production of a hyper-immune serum from non-susceptible animals (mice, pigeons, guinea-pigs, bengali), both with virulent blood and extracts of infected *Culex* mosquitos.
3. By modification of the normal malarial parasite by heat, ether, sodium fluoride, contact with old infected blood and conservation on NNN medium for some days.
4. By inoculation of sporozoites modified by heat, dilution, " ageing " in salivary glands and *in vitro.*
5. By injection of " immature " virus—immature zygotes from insects, and blood drawn from naturally infected birds during the period of incubation.

The results of these vaccination experiments were negative with the two following exceptions :—

1. Sporozoites " aged " *in vitro* (12–48 hours) produced immediate tolerance in 29·5 per cent. of cases.
2. *Plasmodium* parasites drawn from infected birds during the period of incubation produced tolerance in 21·3 per cent. of cases.

In the course of these experiments 965 control birds were used, only seven of which were normally resistant to *Plasmodium* injection.

LAVERAN, M.—*ibid* p. 78—in a brief discussion admits the interest of the above researches, but deprecates the use of the word " malaria." He says that the so-called bird-malaria, being caused by a different parasite from that causing human malaria, is not to be taken as a guide to the control of the latter disease without reserve.

CAUCHEMEZ (L.). **Fréquence des amibes iodophiles chez le porc, en France.** [The Frequency of Amoebae exhibiting an Affinity for Iodine in the Pig in France.]—*Bull. Soc. Path. Exot.* 1921. June 8. Vol. 14. No. 6. pp. 321–322. With 1 text fig.

Amoebae showing an affinity for iodine were first found by WENYON in human stools in 1915. They were at first considered by BRUG (S. L.) in 1919 to be identical with *Entamoeba williamsi*, Prowazek, 1911, but a little later DOBELL identified them with *E. bütschli*, Prowazek, 1912. BRUMPT believes that WENYON'S amoebae are not identifiable with PROWAZEK'S amoebae, and proposes to call them *Iodamoeba wenyoni*, Brumpt, 1921.

In 1920 CONNOR discovered these amoebae in the pig at Funafuti, Ellice Islands (*Med. Jl. Australia*, 1920, Oct. 2, Vol. 2, No. 14, p. 337). In April and May 1921 Cauchemez ascertained the presence of these amoebae and their cysts in the faeces of eight out of 100 pigs, from six to eight months old, slaughtered in Paris. The parasites were plainly visible when examined in the fresh state, but their characters were brought out clearly by the addition of Lugol's solution, which increased their refractility and showed their affinity for iodine. After fixation in Bouin's solution and staining with iron haematoxylin two forms of parasite were seen, viz.: (1) Circular or oblong vacuolated vegetative forms having no membrane, containing a nucleus with a large karyosome, which exhibited a marked iron affinity and were comparable to the vegetative forms found in man; and, (2) circular or oblong vacuolated cysts with a double contour showing but slight affinity for iron; their nucleus contained a spherical mass staining deeply with iron and a crescentic structure less deeply stained. The stained elements were considered by BRUMPT identical with *Iodamoeba wenyoni*.

More careful search for these organisms persuaded the author that they could be discovered in from 50 to 60 per cent. of samples of faeces taken from the pig. The percentage of cases of human infection estimated by WENYON was only 1 per cent. The author therefore concludes that *Iodamoeba wenyoni* is ordinarily a protozoan parasite of the pig in much the same degree as *Balantidium coli*. Like this parasite, however, it is capable in exceptional circumstances of adapting itself to living within the human body; the pig would therefore constitute the primary reservoir of the parasite.

CARINI (A.). **Sur un Leucocytozoon d'une Chouette du Brésil.** [A Leucocytozoon of a Screech-Owl in Brazil.]—*Bull. Soc. Path. Exot.* 1920. July. Vol. 13. No. 7. pp. 506–508.*

The discovery of a Leucocytozoon in a Brazilian owl is an event of considerable interest. In 1908, LUTZ and MEYER reported the discovery of one of these parasites in an owl in the same country, but no particular emphasis was laid on the fact, since they considered that it showed no appreciable difference from types of Leucocytozoon in the owls of the old world. In 1918, MARCEL LEGER, in his reports on very extensive haematological studies in Guiana, remarks on the non-observation of any Leucocytozoon, concluding that possibly the previously reported case may have been open to doubt and suggesting that no leucocytozoon is to be found in South America.

The parasite described in this report was observed by CARINI some time ago, but no mention was made of it at the time, since he decided to wait for further cases in order to make his studies more comprehensive. In consequence of the statements of LUTZ and MEYER, and of LEGER, it seems desirable to describe it now.

The leucocytozoon in question was found in a specimen of *Scops brasiliensis*, and parasites were numerous in the blood and organs. The host cell, which, as is usual in a leucocytozoan infection, was not identifiable, was fusiform and individuals varied from 32μ to 45μ in length. The nucleus was always enlarged, flattened and reduced in staining capacity except at its point of contact with the parasite; here it took the form of a fine, intensely stained narrow strip somewhat broader and rounded towards the ends, so that a "dumb-bell" impression was produced.

As regards the parasites, the male and female gametes were sharply contrasted. The females (macro-gametes) were oval, measuring 15–17μ by 10–12μ, and showed many vacuoles in the substance of an intensely blue-stained cytoplasm; the nucleus was small and sharply circumscribed and in some cases an intensely purple-stained paranucleus was observed very close to the main nucleus. The male gametes were somewhat smaller, measuring 12–14μ by 7–9μ. The protoplasm took on a delicate pink colour and appeared to be homogeneous; in addition the nucleus was large and not sharply delimited. No other forms were seen, but it was incidentally noticed that a species of Halteridium was also present.

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The author is not prepared, on the evidence to hand, to state that the described Leucocytozoon is a new species, but suggests that if further investigations prove it to be such, the name *L. lutzi* be given in honour of LUTZ, who first discovered it.

BENOIT-BAZILLE (H.). **Note sur une** *Grahamella : Grahamella musculi*, **n. sp., trouvée dans le sang de** *Mus musculus*. [Note on a *Grahamella : Grahamella musculi*, n. sp., found in the Blood of *Mus musculus*.]—*Bull. Soc. Path. Exot.* 1920. June 9. Vol. 13. No. 6. pp. 408–416. With 1 plate.*

This article places on record the discovery of a species of *Grahamella* in a host not hitherto recognized as a vector of these bodies, and suggests the provisional designation *G. musculi* to avoid confusion with the many other similar bodies found by various authors in several other animals.

The infection was discovered in two common white mice previously inoculated with *Trypanosoma brucei*, and the bodies were observed in the red corpuscles, sometimes in great numbers ; in some instances up to 50 in one corpuscle.

As regards morphology, the bodies measured 0·5–1·2μ long by 0·2μ broad, being distinctly bacillary in shape. In examining blood smears, affected corpuscles were seen at the rate of about one every five minutes. JOLLY bodies were also seen, but were deliberately excluded from the counts as having no connection with the *Grahamella*.

Beyond some *T. brucei*, with which the mice had originally been inoculated, some JOLLY bodies, and some polychromatic erythrocytes, the blood showed no other abnormality.

The author, quoting the great variety of animals showing *Grahamella* in their blood, and the large variety of other blood parasites with which they have been associated, concludes that these bodies are independent of the other parasites. Of their parasitic nature he is moderately convinced, since the animals in which they were found had been bought in the open market and not bred in the laboratory. Having been kept, probably caged alongside many other species of small animals, it seems probable that the infection may have been transmitted to them by some biting ectoparasite. No such bodies had ever been seen amongst mice bred in the laboratory.

STAMMERS (G. E. F.). **Haemogregarines in Black Rats.**—*Jl. Trop. Med. & Hyg.* 1920. Dec. 15. Vol. 23. No. 24. pp. 298–299. With 3 figs.*

The author recalls a report by KUSAMA, KASAI and KOBAYASHI (*Kitasato Arch. of Exp. Med.* 1919. Oct. Vol. 3. No. 2), in which they record the finding of haemogregarines in wild black rats in Tokio. As these parasites do not seem to have been described as occurring in European black rats this note is of some interest. The parasites here reported were found in Scandinavian black rats caught on timber ships from Sweden, but the author has so far failed to demonstrate their presence in native English black rats.

One of the figures accompanying the note shows a free extracellular parasite (gametocyte) and it is noted that in the rat from which the preparation was made, all the parasites were extracellular. The two other figures are of a haemogregarine and *Trypanosoma lewisi* mixed infection and of a double intracellular haemogregarine infection.

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LANGERON (M.). **Sur une Hémogrégarine d'un Macaque.** [A Haemogregarine occurring in the Dog-faced Monkey.]—*Bull. Soc. Path. Exot.* 1920. Mar. Vol. 13. No. 3. pp. 165–7.*

The author here reports the discovery of a haemogregarine in a monkey (*Macacus cynomolgus*). At the time of its discovery the observers were chary of publishing the fact, as it was not with certainty identifiable. Since then, however, haemogregarines have been seen in primates—by KREMPF in 1917 in a Chinese, and by ROUBAUD in 1919 in a European from the Belgian Congo.

The observation here reported was in the case of a monkey in 1912. This animal had succumbed to experimental inoculation with malaria (*Plasmodium cynomolgi*). In the process of blood examination bodies were encountered, which were described in the following terms :—

" They are considerable bodies (17–19μ by 5–6μ) constituting a mass which stains intensely blue by Romanowsky ; this mass includes a nucleus-like body which takes the azurophile tint characteristic of the chromatin of protozoa. One of these bodies is surrounded by a distinct pink zone and appears to be included in a distended red blood corpuscle ; the others appear to be free in the plasma. The morphology and staining of these organisms suggest the gametes of a haematozoon, but the absence of pigment forces one to discard this idea."

The descriptions given by KREMPF and ROUBAUD of the haemogregarines found in man recalled these bodies, and re-examination of the blood smear proved that they must be of this nature. The pink zone, originally described as encircling one body, had faded away, so that there was no evidence on which to base any statement as to whether they were intra- or extra- corpuscular.

The origin of the parasite remains obscure. The monkey came originally from the East—probably Indo-China—and was at that time presumably affected with haemogregarines. If so, the infection must be persistent, for the animal had been kept in a laboratory for over a year before being inoculated with malaria.

The discovery of this new variety is of interest in that it confirms the infestation of primates by these parasites. Probably their presence is often overlooked owing to their resemblance to *Plasmodium* gametes.

The author here proposes the name of *H. blanchardi* in honour of his former director with whom he was working when the parasite was first observed.

In a later note (*Bull. Soc. Path. Exot.* 1920. June. Vol. 13. No. 6. p. 394), following the information that a parasite was already recognized under the name of *Haemogregarina blanchardi* (BRUMPT and LEBAILLY, 1904), the author suggests the name *H. cynomolgi.*

DELANOE (P.). **De la spirochétose des Gallinacés dans le Cercle des Doukkala.** [Fowl Spirochaetosis in the Doukkala Circle, Morocco.] —*Bull. Soc. Path. Exot.* 1921. June 8. Vol. 14. No. 6. pp. 316–320.

The presence of spirochaetes in fowls was demonstrated by VELU in Morocco in 1918, but since 1915 Delanoe suspected the condition in the Doukkala Circle on account of the high mortality among fowls during the summer, the clinical symptoms, the rapidity with which recovery was brought about by a single injection of novarsenobenzol, and the number of argasid larvae on the fowls, particularly under the wings, during the hot weather. In 1920 the author made a few experiments upon the disease. It was found that the fowl spirochaete could be transmitted to the goose and duck, which subsequently developed serious symptoms and died quickly after intravenous injection with infected blood. The naturally-occurring disease was manifested under two principal clinical types, viz.: (1) The acute type, terminating rapidly in death. Very frequently the natives stated that their fowls died suddenly, and it was particularly at the time when they laid their eggs that they were liable to fall down dead. (2) The subacute or chronic type, with more or less marked paralysis or paresis of the legs. It is probable that there also exists a benign type, with more or less complete absence of visible signs of disease. The transmitting agent was *Argas persicus*, Fischer, which was very abundant in all fowl houses. The larvae, in particular, were very numerous in summer, so much so that the fowls' bodies were thickly covered.

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The spirochaete exhibited usually five or six spirals (max. 8, min. 3). The average length was 14·3μ (max. 19·9, min. 11). The average width was 0·6μ (max. 0·7, min. 0·5). The question as to whether the Moroccan affection is identical with the Algerian disease still remains open. It seemed probable that fowls were not the only animals attacked with the disease, for outbreaks were found to occur among geese and ducks at the same time as the spirochaetosis produced losses in the fowl houses. Although spirochaetes were not discovered in the blood of diseased ducks and geese, support is given to this view by the fact that the author was able to cure a four months' old goose by means of a single injection of novarsenobenzol.

DISEASES DUE TO METAZOAN PARASITES.

ZUELZER (Margarete). **Biologische Untersuchungen an Zecken.** [Biological Researches on Ticks.]—*Zeitschr. f. Immunitätsforschung u. exp. Therap.* 1. Teil. Orig. 1920. Sept. Vol. 30. No. 2. pp. 183–201.*

The ticks considered in this article are the *Argasinae*, and of these *Argas persicus* in particular. This group of ticks is of especial interest in that its members do not remain for any considerable period on their hosts, but indulge in occasional attacks only, behaving more like bugs than like the majority of ticks.

Argas persicus is recognized as the transmitting agent of fowl spirochaetosis, and is closely related to ticks of the genus *Ornithodorus*—the transmitting agents of human relapsing fever.

Argas persicus prefers a habitat which is warm and dry—26°C. being the optimum temperature. It also prefers darkness and normally hides in cracks and fissures where little light penetrates. The individuals vary in appearance according to the amount of food in their alimentary canals, being greyish-brown when fasting and a warm red-brown when recently fed. They can fast for considerable periods—at any rate for three or four months without any harmful results. The statements of some investigators that they can remain without food for a year are probably too liberal. They will remain alive for nine months, but after such a prolonged fast will not feed again. Under natural conditions they suck blood every three or four weeks.

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When placed on a captive fowl the ticks are seen to suck blood in the usual way, changing in shape meanwhile from flat to round; the actual course of the blood may be seen as it flows into the ramifying intestinal system. The meal extends over a period of 20 minutes to an hour or more; some females take up to one and a half hours, but in all cases the ticks leave the host at the end of the meal. A single tick will at one meal suck a quantity of blood about five times its own original body-weight.

At the end of the meal the ticks are round and distended; all irregularities and furrows on the body surface are obliterated. After a variable period, which can be shortened by incubation at 37° C., a large drop of water-clear fluid is secreted by each tick from the coxal glands inside the first pair of legs, and the original wrinkled and flattened appearance returns to some degree. The drop of fluid is usually about the same weight as a fasting tick, and after its excretion the parasite will attack the host once more.

A considerable volume of this fluid was collected from several ticks and tested with rabbit anti-fowl serum in a narrow tube. A distinct zone of precipitation at the junction of the two liquids proved that the excreted drops of fluid were rich in fowl serum proteins. This fact, that an animal can absorb foreign protein and re-excrete it unchanged, is of considerable interest.

In the case of the allied ticks, it was observed that *Argas reflexus* (normally parasitic on the pigeon) behaved similarly, but on rare occasions secreted the drop of fluid while still attached to its host. *Ornithodorus moubata,* however, appears to remain attached in nearly every case, and after excreting its drop of coxal fluid continues its meal without resting.

Further information seemed desirable as to the significance of the drop of secreted fluid. Formerly it had been thought that it was retained during the meal to retard clotting of the ingested blood. At the conclusion of the meal, as it was no longer necessary, it was excreted. From the nature of the fluid and from the behaviour of *O. moubata,* this hypothesis seems unjustifiable. Bearing in mind that the ticks under consideration transmit spirochaetes, it was decided to ascertain whether, and to what extent, the fluid might play a part in the process. Several *Ornithodorus moubata* ticks, known to be harbouring the spirochaete of relapsing fever, were fed on a healthy rat and the coxal fluid collected in capillary pipettes at the moment of its secretion. This fluid, when injected intraperitoneally into a healthy mouse, produced acute relapsing spirochaetosis, with very rich blood invasion. Thus it is quite certain that the fluid plays a part in transmitting disease. Presumably the infected tick sucks blood from the healthy host, and the spirochaete-infected coxal fluid gains entrance to the host's body through the wound made by the mouth parts of the parasites. It has yet to be proved whether the actual bite of the tick is also infective, as is known to be the case with lice. [See, however, MESNIL's explanation, p. 141.—ED.]

Precipitation tests on faecal material from the same ticks failed to reveal the presence of any unaltered protein material from the host. The passage of unaltered foreign protein, however, is not confined to ticks. Many other blood-sucking parasites were found to do the same thing, but in the absence of coxal glands the undigested protein was found to be passed with the faeces.

The life-habits of *Argas persicus*, as in other ticks, appear to be governed mainly by the feeding habits. The ticks can fast for long periods, but during these periods there is no copulation. After a meal, however, the ticks copulate within half an hour to two hours—after excretion of the coxal fluid. The act lasts for a period of from five to fifty-five minutes. It was noticed that the sexual desire in females persisted only for two or three days after a meal, but in males up to a month. In any case the females, provided that they had been fertilized after a previous meal, proceeded to lay eggs within a few days after a meal, even without fresh coition. If fertilized, however, the laying of eggs commences after a rest of from five to fourteen days, the process occupying a period of from three to six days from beginning to end. The number of eggs laid varies from 30 to 300 according to the amount and quality of the blood ingested at the last meal. At the conclusion of the egg-laying process, the females are ready to feed again and the whole process will be repeated. If ticks are being reared it is wise to enforce a rest of some weeks after every third or fourth egg-laying; otherwise the ticks will die of exhaustion.

A point of interest is the length of life and of fertility in *Argas* ticks. The author quotes an instance of a male and female known to be four years old; after copulation the female laid 50 eggs.

The nature of the blood ingested is as important a factor as the quantity. The ticks will feed on guinea-pigs for years and remain apparently normal, but the number of eggs laid is greatly reduced. Experiments were therefore instituted in order to determine whether fowl proteins were embodied in the substance of the eggs. A rabbit was injected with egg extract, but the resultant serum, although highly specific against tick egg albumen, gave no positive results when tested against fowl serum (precipitation tests). This same rabbit's serum was used for similar tests against egg extracts of various other Arthropoda, but with negative results in all cases, except with the egg extract of *Argas reflexus*, thus proving a very close relationship.

The larvae, which hatch out in from one to three weeks, according to the temperature, also show a distinct precipitation reaction with the same rabbit serum. After they have once fed on a fowl, however, their extract reacts to anti-fowl serum only, and after their first moult reacts to neither anti-tick-egg nor anti-fowl serum.

The first moult occurs when the larvae are from a fortnight to a month old, and the nymphs appear. The nymphs undergo four moults, the first three at approximately fortnightly periods and the fourth and last anything up to a month after the third. After each moult the nymph is obliged to feed, but cannot do so for a few days, as time must be allowed for the chitin of the mouth parts to harden.

The adults bite at the fourth or fifth day, but do not become fully engorged. After a rest of a day or two they bite again and gorge fully, after which they copulate and, in the case of females, lay eggs.

The whole life-cycle may take nearly six months in the colder part of the year, and in the summer time may be as short as three months.

The most important biological points indicated in these researches are referable throughout to the feeding habits of the ticks under consideration. They can remain for long periods without food, and during the fasts the body functions are inhibited. When food is plentiful, on the other hand, the whole life process is accelerated. Again, in virtue of their parasitic habits the ticks are often saturated with foreign albumen, so much so that it may be demonstrated by precipitation tests in their glandular secretions. In spite of this, each stage of the life-cycle may, however, be shown to have its own specific proteins.

GATES (William H.). **A Method of Concentration of Parasitic Eggs in Faeces.**—*Jl. Parasitology.* 1920. Sept. Vol. 7. No. 1. p. 50.*

"After straining through a sieve a large quantity of material, or using a smaller quantity without this, faeces are centrifuged first with water to wash off surplus lighter material, and later with sodium chloride, or, better, calcium chloride solution, specific gravity 1·250, to remove the bulk of the material and float the eggs practically free from sediment. The top 1 or 2 cc. are then removed with a pipette, drawing chiefly from the rim of the meniscus, and centrifuged again with water, which throws the eggs to the bottom. . . . . The sediment is agitated vigorously by holding the tube in the closed hand and pounding on the table. This stirs up all, or nearly all, of the eggs which may have stuck to the bottom, though a few eggs cannot be removed except with a brush. The sediment is quickly poured into a small dish. The centrifuge tube is rinsed out by squirting water forcibly into it, and this also is poured immediately into the dish. The eggs settle rather rapidly and are loosened from the bottom by forcing a little water around the edge to produce a slight whorl. Then, before the eggs have a chance to settle, agitate the dish in the same circular direction so that the water tends to form a vortex, gradually diminishing the motion. . . . . Practically all the eggs will be found to have settled within a very small field.

"For gross examination with the low powers, the eggs may be left in the dish and examined directly. To examine more carefully, under a high degree of concentration, draw up with a pipette a small quantity of water from the centre of the mass of eggs; hold this vertical and steady for half a minute or so. Most of the eggs will settle, so that a single drop forced out on the slide will contain nearly all, if not all, of the eggs drawn up into the pipette. For still further concentration allow the eggs on the slide to settle, and then with a blotter or lens paper very carefully remove a portion of the water from the top of the drop and add another drop. If repeated with care, a large mass of eggs may be collected in the space of a cover-slip. This is especially satisfactory if the eggs have been in alcohol, for the alcohol will evaporate, leaving the eggs in the centre."

HORNBY (H. E.). **Some Notes on Liver Fluke Disease as Observed in Northern Rhodesia.**—*Vet. Jl.* 1921. May. Vol. 77. No. 5. pp. 171–174.

In Northern Rhodesia and the adjoining countries, *Fasciola gigantea* has become the cause of widespread ravages among the cattle population. The rainy season in these countries occurs from November to April, and during the dry season the rivers dry up and water is obtainable only from isolated pools and springs. Until recently the intermediate host of the liver fluke in South Africa was not known, but the researches of CAWSTON (F. G.) and of PORTER (A.)

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have indicated that *Limnoea natalensis*, together with some other water snails, such as *Physopsis africana*, are capable of harbouring the intermediate stages. The cercariae identified by CAWSTON as *C. pigmentosa* have been found by PORTER to be a stage in the life-cycle of *F. gigantea* [see this *Bulletin*, 1920. Vol. 8. No. 3. p. 206].

The above-named two species of snail are common in Northern Rhodesia throughout the whole of the rainy season, and Hornby found that they harboured numerous cercariae. During the dry months they are not so readily found. The snails flourished best in the kind of water which forms apparently the ideal drinking place for cattle, viz., the backwaters of the great rivers and the shady grass-fringed pools of the " sweet vleis." The Physa snail appears to be unisexual, and eggs are laid in packets of about 25, which appear to hatch out after only a few days' incubation, and the young snails attain full size within a month. Neither snails nor eggs appear to be resistant to desiccation, and re-stocking of pools seems to be effected every year by the floods.

It is therefore advised that the low-lying pastures should be avoided during the rainy season and cattle watered in the rapidly flowing small streams with sandy banks devoid of vegetation. Unfortunately the best ranches of Northern Rhodesia lie along the banks of the great swampy rivers, the plains on each side of which are deep under water during the rainy season, but gradually dry up later, furnishing, as the water recedes, an abundance of excellent grass during the whole season of drought. It is difficult to devise any measures for ridding such ranches of water snails, and large areas of excellent grazing are therefore spoilt by the presence of flukes.

The effect of invasion is most marked in cows and yearlings, and an infested cow becomes rapidly emaciated after parturition. Young stock vary much in the extent to which they show signs of infection. Adult oxen show very little outward appearance of infestation even when their livers are full of flukes. No signs of acute peritonitis or hepatitis were noticed in cattle during the passage of the parasites via the peritoneal cavity. Diagnosis is easily made by post-mortem examination of any apparently affected animal in a herd. Medicinal treatment did not give promising results. Male fern was considered to be too expensive for general use. Kamala was given by placing an ounce of it on the back of the tongue on two successive evenings, but hitherto no good results have been obtained.

CHRÉTIEN (A.). **Onchocercose du Zébu de Madagascar et du Boeuf de France.** [Onchocerca Infection of the Zebu in Madagascar and of the Ox in France.]—*Rev. Path. Comp.* 1921. Feb. 5. Vol. 21. No. 176. pp. 46–49.

During the course of work in connection with a meat preserving factory in Madagascar from 1917 to 1919, the author observed the presence of a nematode, often in large numbers, in nearly all the zebus examined. The parasite invaded the connective tissue around the ligaments and tendons, but it did not appear to be able to penetrate these structures. It was especially in the neighbourhood of the cervical ligament, in the median connective tissue of its various layers, that the lesions provoked by this parasite could be seen, and even the parasites themselves when the lesions were at their commencement.

Although they were not so easily visible, both parasites and lesions were quite numerous in the connective tissue surrounding the periarticular ligaments and, in particular, in the connective tissue surrounding the knee and hock joints and in the connective tissue of the limb tendons.

When the parasite is isolated, as is often seen when the invasion affects the limb tendons, it is not easy to demonstrate it. Nevertheless, on close examination one can perceive within the connective tissue a worm of about the thickness of fine thread, which is always twisted or more or less loosely entangled, and hence it is impossible to follow it along its whole length. No macroscopic lesion can be seen around isolated individuals at this stage. The parasite can be easily extracted in fragments. The extracted portion takes the form of a thin, silky, supple thread often from 10 to 20 cm. long, and assuming of its own accord an irregular corkscrew arrangement. If instead of a single organism several are situated in the same place, as is usually the case in the cervical ligament, the connective tissue becomes slightly thickened and a little opaque and rough.

The connective tissue always adheres fairly closely to the tendinous tissue at the infested part. The lesions are distributed in irregular zones of more or less considerable size, of a somewhat brownish tint and surrounded by oedematous zones often of rather considerable extent. In the central zone of such lesions one may perceive a certain number of parasites in the form of small packets of worms, the presence of which sets up a distinctly inflammatory reaction in the invaded tissue. The worms may still be fairly readily extracted partially, but they are no longer supple. In other lesions a state of chronic inflammation is found to have become established. There is no longer to be found an oedematous condition of the connective tissue, and all that remains is a thickened, firm connective tissue zone of a whitish colour, within which may be found brownish entangled parasites of an appearance exactly recalling that of fine vermicelli. The small portions that can be extracted are now quite brittle. When the parasites are abundant there are often found within these lesions small greenish abscesses from the size of a pin's head to that of a pea. Moreover, there are often seen irregularly shaped nodular swellings of a dull white colour enclosing a firm homogenous caseous material. The various appearances exhibited by these lesions represent successive stages in the development of the parasite.

Again, histological examination lends confirmation to these deductions.

When examined microscopically the parasites appear as nematodes possessing a thick striated cuticle showing spiral thickenings interrupted in the neighbourhood of the lateral aspects of the body. The parasite thus belongs to the genus *Onchocerca*.

The author subsequently made a search among cattle slaughtered in Paris in order to find out whether similar manifestations could be found. It was discovered that the worms were quite frequently present in the connective tissue covering the cervical ligament, but beyond this situation the parasite was not found in the numerous other situations in which it could be discovered in the Madagascar zebus. As in the case of the zebu, investigations bearing upon its presence in the aorta of the ox gave negative results and histological examination of the frequently occurring atheromatous lesions did not disclose any evidence of parasitic infection. The lesions in the cervical ligament were exactly similar to those found in the zebu, with the exception that in the final stage the parasite was often totally calcified. Microscopic examination of the parasites likewise showed that they belonged to the genus *Onchocerca*, but the species to which they belonged has not yet been determined. Whilst it might be stated that all adult zebus in Madagascar were affected, the cervical ligament of French cattle was affected in 71 per cent. of cases. The author entertains the hope that the discovery of the infection among cattle in France will lead to the elucidation of the life-cycle of the parasite. [This question has been somewhat anxiously studied in Australia, where Onchocerca infection, particularly in the brisket, renders the affected meat unsaleable.—ED.]

HALL (Maurice C.). **Carbon Tetrachlorid for the Removal of Parasitic Worms, especially Hookworms.**—*Jl. Agric. Res.* 1921. April 15. Vol. 21. No. 2. pp. 157–175.

Experiments carried on in the Zoological Division in the United States Bureau of Animal Industry indicated that carbon tetrachloride (CCl_4) is a very promising drug for the treatment of hookworm infestation in dogs, and it would also appear that it may be of use in the treatment of ankylostomiasis in man and in domesticated animals other than the dog. Hall reviews the work that has been done in connexion with the medicinal use of this drug. At one time it was thought that its administration was indicated for the same purposes as those for which chloroform was used, but for the last 50 years it does not appear to have been much employed for this purpose on account of the belief that it had a more depressant effect upon the heart than chloroform had, and its volatility and supposed difficulty of elimination were objections to its use in large doses. During recent years it has been largely used as a hair shampoo, but about two cases of fatal intoxication are on record in the human subject. BISHOPP (F. C.), of the U.S. Bureau of Entomology (1920), stated that the drug irritates wounds and retards healing, and two stockmen were under the impression that they killed two calves and one steer by its use in cases of screw-worm infestation. The substance has also been somewhat extensively tried as an insecticide, but it would appear to be inferior in this respect to carbon bisulphide and sulphur dioxide. During the war, however, it was noted to be an effective insecticide for lice.

Carbon tetrachloride is less volatile and distinctly less soluble in water than chloroform or carbon bisulphide. It does not seem to diminish the tone or contractility of unstriped muscle. It also boils at a temperature 15–30° C. higher than the other two substances mentioned. It may carry impurities such as phosgene and carbonyl chloride, so that care should be taken to obtain pure samples of the drug.

In the experimental tests on dogs the method employed was the same as that used in the author's previous work on anthelmintic efficacy [see this *Bulletin,* 1918, p. 103].

The animals were submitted to treatment and all faeces passed were collected once a day for 3–6 days, screened, and the worms passed were identified and counted up to the time when the animals were killed; the worms present post-mortem were then identified and counted, and any lesions that might be due to the drug noted. In the first batch of 20 dogs the drug was administered in capsules after fasting for 18–24 hours, without preliminary purgation. In seven cases where the dogs harboured *Dipylidium* sp., treatment with the drug in doses from 0·2–1 mil (cc.) per kilo body weight was entirely ineffective against this tapeworm; it is therefore regarded as of no value against Dipylidium or probably against tapeworms of other genera. With regard to nematode worms, however, the results were as follows :—

At the rate of 0·1 mil per kilo, to four dogs: hookworms 23 removed, 30 left (43 per cent. efficacy); ascarids 34 removed, 9 left (79 per cent. efficacy); whipworms none removed, 2 left (0 per cent. efficacy).

At the rate of 0·2 mil per kilo, to four dogs: hookworms 1 removed, 3 left (25 per cent. efficacy); ascarids 1 removed, 1 left (50 per cent. efficacy); whipworms none removed, 11 left (0 per cent. efficacy).

At the rate of 0·3 mil per kilo, to nine dogs: hook worms 34 removed, none left (100 per cent. efficacy); ascarids 6 removed, none left (100 per cent. efficacy); whipworms 19 removed, well over 200 left (less than 10 per cent. efficacy).

At the rate of 1 mil per kilo, to one dog: hookworms none present; ascarids 2 removed, 1 left (67 per cent. efficacy); whipworms 16 removed, none left (100 per cent. efficacy).

At the rate of 1·5 mil per kilo, to one dog: no worms removed, but none found post-mortem. No ill-effects as the result of the treatment were observed ante-mortem or post-mortem.

From these experiments it would appear that a dose-rate of 0·3 mil per kilo is necessary to remove efficaciously hookworms and ascarids. On the other hand, whipworms, as the author has previously pointed out, cannot be removed with certainty by single-dose treatment with any known anthelmintic.

In a second series of experiments the drug was administered by drench instead of in capsules, to fasting dogs, without purgation. The result was :—

At the rate of 0·3 mil per kilo, to three dogs: hookworms 16 removed, 22 left (42 per cent. efficacy); ascarids 43 removed, 22 left (66 per cent. efficacy); whipworms none removed, 95 left (0 per cent. efficacy). It is thus evident that the drug ought to be introduced in capsules in order to develop its maximum effect.

When given in large doses without capsules the drug was found to produce transient toxic effects which were attributed to the inhalation of the drug. A dog was thus administered: 1 mil per kilo of the drug in castor oil; half of this was first given without capsules and the second half afterwards in capsule. The dog went down and stiffened for a short time, and then arose and staggered about as if intoxicated for a few minutes. It soon became normal in behaviour and appearance, and at the end of four months' observation showed no evidence of ill effects.

In order to ascertain whether thymol, which is readily soluble in carbon tetrachloride, could, if added to it, produce an increase in anthelmintic efficacy, a solution was made up containing 10 gr. of thymol per 1 mil carbon tetrachloride. This solution was administered in capsules after fasting without purgation.

The result was :—

At the rate of 0·3 mil per kilo, to three dogs: hookworms 66 removed, none left (100 per cent. efficacy); ascarids, none present; whipworms none removed, 22 left (0 per cent. efficacy). The mixture would therefore be as effective as carbon tetrachloride alone in the same dose, and a larger series of experiments might show that it was more effective.

Likewise, in order to ascertain whether oil of chenopodium could be added to carbon tetrachloride, with an increase in anthelmintic efficacy, a solution was made up, containing 3 mils of the latter drug to every 1 mil of the former. The solution was administered in capsules after fasting and without purgation. The result was :—At the rate of 0·3 mil per kilo, to two dogs: hookworms 110 removed, none left (100 per cent. efficacy); ascarids 8 removed, none left (100 per cent. efficacy); whipworms 65 removed, 12 left (84·5 per cent. efficacy); *Dipylidium* sp. none removed, 1 left (0 per cent. efficacy). The mixture was therefore as effective as carbon tetrachloride used alone in the same dose, and a larger series of experiments might show that it was more effective. This mixture was also given at the same dose-rate, by means of a syringe, to one dog that was too savage to be dosed successfully by means of capsules. The method, however, resulted in complete failure, inasmuch as part of the dose was necessarily lost and partly evacuated from the mouth and by slobbering.

Hall next summarizes the results he had previously obtained after the administration of other anthelmintics for the treatment of hookworm infestation. The drugs tested were chloroform and chenopodium, alone and in mixture, and thymol. Chloroform in doses of 0·1 to 2 mil per kilo in castor oil was only 54 per cent. effective against hookworms, while in single and repeated doses in soft capsules it was entirely ineffective. Chenopodium and its constituents in single or repeated doses had an average efficacy of 20 per cent. against hookworms ; in the doses commonly employed for removing hookworms from man (three 10 min. doses at one hour intervals), it was only 30 per cent. effective, and its maximum efficacy in any series of dogs used was only 74 per cent. Chloroform and chenopodium mixed, for all cases reported, showed an average efficacy of 69 per cent., the maximum efficacy for a series being 89 per cent., in cases where dogs were given three 5–10 minim doses in soft capsules at one hour intervals, each dose, accompanied by half an ounce of castor oil, and followed half an hour later by 4 mils of chloroform in half an ounce of castor oil—this dose of chloroform being in excess of 0·3 mil per kilo for the average dog (a 10-kilo dog). Thymol showed an efficacy of 15 per cent., and according to tests made by GAIGER, it left hookworms in seven out of nine dogs treated, with no evidence as to infestation in the other two dogs.

Hall claims that none of the drugs hitherto experimentally tested have shown the 100 per cent. efficacy against hookworms displayed by carbon tetrachloride. The best results obtainable were those given after the use of repeated doses of chenopodium, followed by chloroform. Chloroform alone appeared to be better than chenopodium alone, while the results obtained with thymol were very poor.

The author, moreover, carefully studied the ante-mortem and post-mortem conditions of the dogs undergoing treatment. He concludes that " it appears to be a very safe drug, giving rise to no evident symptoms or post-mortem lesions, even in doses five times as large as are necessary to give dependable efficacy against hookworms. It is cheap and deserves to be tested in human and veterinary medicine. Because of the possibility of impurities, only a pure and carefully refined carbon tetrachloride should be used. While this drug deserves consideration, with especial reference to hookworms, it is also very effective for removing ascarids, being somewhat inferior to chenopodium in this respect, and will remove whipworms, as other anthelmintics will, when it gets into the caecum. It is not of value against tapeworms."

MYCOTIC DISEASES.

VELU. **Le diagnostic de la lymphangite épizootique par l'examen microscopique des frottis sans coloration.** [The Diagnosis of Epizootic Lymphangitis by Microscopic Examination of Unstained Smears.]—*Rec. Méd. Vét.* 1921. Mar. 30. Vol. 97. No. 6. pp. 127–129.*

The method suggested by Velu is one particularly suited to the colonial veterinary officer, who must often travel over considerable distances without a microscope, thus making direct examination of fresh pus impracticable.

The technique consists in making the pus smear in the ordinary way and fixing in a mixture of alcohol and ether. The cryptococci show up as ovoid bodies, either free or intracellular, with a slightly bluish, highly refractile membrane. This is enclosed in a double-lined contour, the inner contour appearing as a distinct sharp black line. This picture is quite characteristic, as the black line separating the outer bluish layer from the central material (which is somewhat pink in colour) must be unmistakeable.

This method is, of course, for simple diagnosis only, and not for pursuing a study of the cryptococcus.

BACHMANN (A.). **Sur la présence de cryptocoques pathogènes dans les ganglions des chevreaux goitreux.** [On the Presence of Pathogenic Cryptococci in the Glands of Goitrous Kids.]—*Bull. Soc. Path. Exot.* 1921. Apr. Vol. 14. No. 4. pp. 199–202. With 2 figs.*

Attention was first drawn to the possibility of a cryptococcus infection of young goats following a post-mortem examination made on a kid sent to the author's laboratory. The peripheral lymphatic glands were greatly enlarged, the inguinals and axillaries especially. Portions of these glands were retained for histological examination and experimental inoculation.

Histological examination revealed the presence of very large cells in the lymph nodules, measuring on an average 16 by 13μ, with a vesicular faintly staining nucleus measuring 8 by 6μ.

Inside these cells other bodies were to be seen, varying in number from one or two to ten or twelve in each cell. These included bodies stained intensely with ordinary basic stains and were gram-fast. For the most part they were ovoid in shape and stained regularly, but some forms were seen in which the stain was distributed in the form of bands or points or in some cases confined to the two poles.

Experimental inoculation of triturated material into guinea-pigs produced symptoms of general discomfort in from 10 to 15 days. The peripheral lymphatic glands became swollen and tense, but in no case was the disease fatal; the guinea-pigs gradually became more natural, and the swellings in the glands subsided.

Some guinea-pigs were destroyed at the height of the period of indisposition and their lymphatic glands examined histologically. A similar picture was presented to that seen in the glands of the kid which provided the original material. In the guinea-pig the large cells measured on an average 18 by 16μ, and the included bodies from 1·8 to 3·6μ.

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* Abstracted by Mr. S. C. J. Bennett, B.Sc., M.R.C.V.S.

All attempts at cultivation failed.

It is suggested that the bodies described here may be cryptococci; the hypothesis being based on morphology, staining reactions and difficult cultivation.

BACTERIAL DISEASES.

BASSETT-SMITH (P. W.). **Para-Melitensis Infection in Man and Animals.**—*Jl. of Trop. Med. & Hyg.* 1921. Mar. 1. Vol. 24. No. 5. pp. 53-54. With 2 figs.*

The *Micrococcus para-melitensis* first isolated by BRUCE was shown to be specific and distinct from *M. melitensis* by NÈGRE and RAYMOND. The specificity was based on the results of agglutination and adsorption tests in addition to animal inoculation.

In this article attention is drawn to the group similarity between *M. melitensis*, *M. para-melitensis* and *B. abortus* (BANG). It appears that *M. para-melitensis* is distinctly more bacillary in form than the true *M. melitensis*, being in fact morphologically almost indistinguishable from BANG'S abortion bacillus. From the results of experiments by other investigators it seems that Malta fever and BANG'S abortion organisms are biologically related also; this is a matter of great importance from a lacto-diagnostic point of view, particularly as many goats in the Mediterranean countries are said to be infected with *M. melitensis* or *M. para-melitensis*. The question is worthy of further investigation. [*See also* this *Bulletin*, 1920, Vol. 8, No. 4, p. 323.]

ROÉLAND (C.) & CHRÉTIEN. **Pasteurellose du lion.** [Pasteurellosis in the Lion.]—*Rev. Path. Comp.* 1921. May 5. Vol. 21. No. 182. pp. 168-171

Towards the end of 1920 the authors had occasion to examine three adult Soudanese lions belonging to a menagerie in the neighbourhood of Paris. These lions were kept in the same cage and all died within a few days of each other, showing much the same symptoms.

The first animal had frequently showed signs of intestinal trouble, and bore a fistula in the jaw which was continuously discharging a little. The first signs of serious illness were frequent vomition, and the animal appeared dull, very thin, and the coat was rough. Suppuration from the jaw had ceased. Four days later the animal was very much worse and extremely emaciated and showed complete loss of appetite. There was oedema of the lips and forearm. The animal died this day, but no post-mortem examination was made.

The second animal had never shown signs of illness previously, except that at one time it had had abscess in the jaw. At the time that the first animal died it was in complete health, but nine days later there appeared oedema of the lips and limbs and the suppurative discharge from the jaw ceased. On the following day the animal succumbed. Post-mortem examination was made the next day. The subcutaneous tissue in the region of the chest was oedematous, the lungs and bronchial glands were markedly congested, and the myocardium was discoloured towards the apex of the heart, whilst the endocardium was markedly tinged. The liver was enlarged and congested, the spleen appeared normal, the kidneys were congested, the mucous membrane of the stomach was of a livid red colour; the intestine appeared normal, but the mesenteric glands were swollen. Stained smears from the lung, spleen and mesenteric gland showed, besides a few rare Gram-staining bacilli and cocci, numerous very delicate ovoid forms with a clear centre which did not stain by Gram. Cultures made from these organs showed, besides a few rare streptococci, numerous pasteurella colonies.

Two guinea-pigs were inoculated, one intraperitoneally and one subcutaneously, with material from the lungs. The guinea-pig inoculated intraperitoneally died within 24 hours, and, post-mortem, it showed exudative peritonitis, with a slight purulent deposit on the borders of the liver, intestinal congestion, slight enlargement of the spleen, and a small amount of exudate in the pericardial cavity. Microscopic examination disclosed abundant pasteurella organisms in the peritoneal fluid and spleen. Cultures made from the blood, pericardial and peritoneal fluids gave rise to a pure growth of pasteurella organisms.

The guinea-pig inoculated subcutaneously fell ill in 24 hours and died within 48 hours after the injection. Post-mortem there was seen a small abscess at the point of inoculation, together with congestion of the neighbouring subcutaneous connective tissue, a small amount of peritoneal exudate and slight enlargement of the spleen. The peritoneal exudate and pus disclosed pasteurella organisms on microscopic examination. Cultures made from the blood and brain developed the organisms in a state of purity.

The third lion had also been in a state of very good health, but it was found sometimes to lick the abscesses on the first two animals. It suddenly became ill eight days after the death of the second animal and showed symptoms of extreme depression and loss of appetite, and died on the following day, 15 hours after the first appearance of symptoms. A post-mortem examination, however, was not performed until 48 hours after the death of the animal, when generalized congestion of all the organs was found, as in affections of the haemorrhagic septicaemia type. In particular, several small pneumonic foci were discoverable in the right lung, together with congestion and enlargement of the spleen. Microscopic examination of the blood, spleen, and bronchial glands disclosed fairly numerous pasteurella organisms, together with so-called malignant oedema and coliform organisms. The same forms were observed in cultures. Inoculation was not performed on account of the degree of invasion with organisms of the malignant oedema type.

The authors think it is admissible that these three cases represent pasteurella infections. The weather at the time of the fatalities was extremely cold. [However, the post-mortem examinations were not made until 24 and 48 hours after death, and therefore conclusive proof is not furnished by these observations. It would have been necessary to examine heart blood immediately after death in order to exclude the probability of post-mortem invasion with the pasteurella organisms.—Ed.]

LITCH (V. M.) & MEYER (K. F.). **A Spontaneous Epidemic among Laboratory Rabbits caused by a Paratyphoid Bacillus related to the Rodent Group.**—*Jl. Infect. Dis.* 1921. Jan. Vol. 28. No. 1. pp. 27–42.*

The organisms responsible for spontaneous bacterial infections among laboratory or breeding rabbits are most commonly *B. cuniculisepticus* and *B. bronchisepticus*, but a case in which true paratyphoid B was the exciting factor is here reported. From the information available this is, apparently, a rare cause, but several cases are on record.

According to KRUMWIEDE, VALENTINE and KOHN (*Jour. Med. Research*, 1919, Vol. 34, p. 449) the paratyphoid strains isolated from guinea-pigs, mice, rabbits and cats, differ antigenically from human paratyphoid B strains (*B. schottmülleri*) and, in their view, belong to a distinct type or group—so-called " rodent paratyphoid."

In the outbreak here reported the disease was introduced among a lot of rabbits purchased for the laboratory, one of which—a female—was found to have diarrhoea and showed signs of a previous abortion. The animal died a few days afterwards, and four other rabbits that had been in contact with it subsequently succumbed.

The symptoms exhibited were high temperature, hair rough and easily shed, in some cases a sero-purulent nasal discharge, loss of appetite, great thirst and marked pallor of mucous membranes, due to a distinct drop in haemoglobin from 90 to 52 per cent. The animals developed severe diarrhoea a few days before death, which was frequently accompanied by a paresis of the posterior extremities and involuntary passage of urine. There was a quickened pulse, laboured breathing, a fall of temperature and convulsions signalizing the approaching termination in from 4 to 8 days after the onset of symptoms.

The principal lesions were: More or less marked emaciation. The anterior lobes of the lungs were covered with a thin layer of fibrin, the lung parenchyma was consolidated in lobar distribution or showed an infarct-like area surrounded by patchy pneumonia. The anterior portion of the middle lobes showed red and grey hepatization. The blood was thin, and sometimes of a brownish tinge. The spleen was considerably enlarged, engorged, pulpy, and of a dark brown colour. Both kidneys were enlarged, yellowish-brown in colour, and showed petechiae and extensive parenchymatous degeneration. The mesenteric lymph glands were enlarged and haemorrhagic. The liver was increased in size and either dark or pale in colour, friable, and dotted with small necrotic foci of varying sizes. The gall bladder was distended by a dark olive-green viscid bile, and its wall was thin and soft, but no changes were visible in the mucous membrane. The duodenum was filled with stringy bile-tinged mucus and its mucous membrane was swollen and showed petechiae. Peyer's patches in the jejunum were swollen, deep red, ulcerated, or covered by brownish-red scale-like sloughs. The sacculus rotundatus was considerably thickened, the lymphatic structure being studded with numerous deep haemorrhages and small pinhead-like abscesses. The mucous membrane showed extensive sloughs in two spontaneous cases, as did that of the appendix, and was covered by a glossy, blood-tinged slime. In two rabbits infected artificially by feeding the wall of the caecum and colon was strikingly rigid, with a diffuse diphtheritic necrosis of the mucous membrane in contrast to the scattered ulcerations observed in the spontaneously infected animals. The uterine horns of two rabbits were enlarged, contained partially dissolved, putrid foetuses, and an endometrium covered with yellowish necrotic areas, thus suggesting the possibility that certain types of abortion in rabbits may be caused by paratyphoid bacilli. In one case the epididymis was oedematous, haemorrhagic, and showed on section numerous areas of necrosis.

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* Abstracted by Mr. T. J. Bosworth, B.Sc., D.V.S.M., M.R.C.V.S.

Histological examination of some of the organs revealed changes not commonly encountered in paratyphoid infections of laboratory animals. An endarteritis and endophlebitis were noted in every tissue, not only in the spontaneously, but also in some of the experimentally, infected animals. Again, the characteristic hyperplastic reaction regularly found in human typhoid fever was entirely absent, or indicated only by a few scattered microphages and phagocytes.

The organism isolated on brilliant green eosin agar or peptic endo-agar from the heart blood, intestinal content, wall of jejunum, ileum, sacculus rotundatus and caecum, liver, spleen and lung was a gram-negative, motile bacillus. The result of fermentation and other biochemical reactions showed that it belongs to the *B. schottmülleri* type of the colon-typhoid group.

Agglutination Tests.—The strains isolated from the various tissues were readily agglutinated in the first generation by a polyvalent human paratyphoid B (*B. schottmülleri*) serum in a dilution of 1 : 500 and were not influenced by a highly potent *B. enteritidis* serum in dilution above 1 : 10. Agglutination tests with antisera against paratyphoid strains of rodent, avian, porcine and human origin showed that the organism isolated is a paratyphoid B closely related to the rodent type of this large group and does not belong to the avian, human or porcine type.

Pathogenicity.—The rapid progress of the epizootic indicates that the organism was of a virulent type, and transmission from rabbit to rabbit probably took place by way of the digestive tract in the form of a feeding infection. Mice and guinea-pigs inoculated subcutaneously with a minute dose died in 12–24 hours. The organism was not fatal to rabbits in small doses by subcutaneous inoculation, but produced more or less extensive necrosis and local abscesses. After ten days the animal's serum would agglutinate the bacilli in dilution of 1 : 400 to 1 : 800. Intravenous inoculation, on the other hand, was fatal in comparatively small doses in 2–10 days, and it produced a diphtheritic or even necrotic cholecystitis. Feeding experiments on coccidiosis-free rabbits proved that the ingestion of two billion recently isolated organisms produced the disease, with characteristic lesions, but that on subcultivation the organism gradually lost its virulence, until ultimately very large doses were necessary to infect. Infection by feeding did not produce a cholecystitis, thus agreeing with the spontaneously infected cases, but differing from those set up by intravenous injection. The bile, too, remained sterile, thus suggesting that in natural cases in rabbits infection of the gall bladder, when it occurs, is not due to an ascending invasion via the common and cystic duct, but is probably the result of descending invasion.

Toxin Production.—When grown in peptonized sugar-free veal broth plus 0·1 per cent. glucose, the organism produces a toxin which is rapidly fatal to rabbits by inoculation, but it should be noted that the reaction of the medium must be adjusted to a PH of 8·4. With a PH 7·2–7·4 the filtrate is not nearly so powerful.

The possibility of the organism here considered being concerned in food poisoning in man must not be overlooked. In one instance McConkey (*Journ. Hygiene,* 1906, Vol. 6, p. 570) isolated a paratyphoid organism from the leg of a rabbit which was suspected of causing an outbreak, but although he was able to prove in the particular instance that the rabbit when purchased was fit for human consumption and that contamination took place at the consumer's house, yet the ability of the organism, described in this article as setting up a disease of rabbits, to evolve a potent toxin should be considered in any attempt to explain outbreaks of food poisoning in which rabbit flesh is part of the suspected meal.

The history of this epizootic among rabbits emphasises the necessity for laboratory workers to make a thorough investigation of the death of all stock animals and to impose a strict quarantine of at least two weeks on all animals received into the laboratory.

Graham (Robert) & Schwarze (H.). **Avian Botulism (Type A) or Limber Neck.**—*Jl. Infect. Dis.* 1921. April. Vol. 28. No. 4. pp. 317–322.*

The disease known as limber neck has been recognized for many years in the poultry flocks of America. It is of a toxaemic nature and occurs sporadically. The symptoms exhibited are weakness, inco-ordination of movement, prostration, coma and inappetence, while the striking feature of the disease is a weak pendulant or limber neck.

It is possible that this train of symptoms may be induced in poultry by a variety of agents, but there is evidence to show that at least in some natural cases the causal organism is *B. botulinus* Type A. In investigating a case of botulism in man, Dickson (Monograph No. 8, *Rockefeller Inst. for Med. Research,* 1918) noticed that a fatal illness in chickens developed simultaneously, and he was able to induce the disease in healthy chickens by feeding them with contaminated human food and to isolate *B. botulinus* from the alimentary tract of the affected birds. Other investigators who had attempted to confirm his results by feeding *B. botulinus* toxin to chickens had failed to set up the disease, but the authors of the present article were successful when using the toxin of several strains of *B. botulinus,* each of which proved to be *B. botulinus* Type A.

Their results were quite negative with strains of *B. botulinus* Type B, which strongly suggests that the failure of the other investigators to induce the disease was due to their working with strains of the latter type.

It is an important fact, however, that although chickens do not become diseased when fed with *B. botulinus* Type B, yet the faeces of chickens fed with this strain are highly toxic to susceptible animals, which indicates that the virus may be distributed in nature by apparently healthy chickens or other resistant animal species.

The results here reported strongly suggest that the type of any strain of *B. botulinus* may be readily and accurately recognized by feeding the toxin to chickens. In an outbreak of botulism the type responsible may be preliminarily determined by feeding the unaltered contaminated food to chickens. Moreover, should an outbreak of botulism in animals reveal the remote or even simultaneous occurrence of limber neck in chickens, the authors recommend the use of specific *B. botulinus* antitoxin Type A, and they further believe that the latter antitoxin is indicated in the treatment of this disease in poultry in preference to the polyvalent variety. They have proved experimentally that Botulinus antitoxin Type A is a specific prophylactic, the injection of 50 units being quite sufficient to protect mature chickens against 800 lethal doses of toxin for guinea-pigs. The curative value of the antitoxin in chickens has not been tested sufficiently to permit of definite conclusions.

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* Abstracted by Mr. T. J. Bosworth, B.Sc., D.V.S.M., M.R.C.V.S.

Type B antitoxin has no effect in controlling the disease as induced by Type A.

DISEASES DUE TO FILTERABLE VIRUSES.

TITZE (C.) & SEELEMANN (M.). **Weitere Untersuchungen über die Lungenseuche des Rindes und über die Differenzierung sogenannter ultramikroskopischer Seuchenerreger.** [Further Researches on Bovine Pleuro-pneumonia and on the Differentiation of the so-called Ultramicroscopic Viruses.]—*Berliner tier. Woch.* 1921. Jan. 20. Vol. 37. No. 3. pp. 29–31.*

The virus of contagious bovine pleuro-pneumonia is of great interest in that it should serve as a starting point for the investigation of filterable viruses. It is itself "filterable," but is none the less visible and capable of being cultivated, as in MARTIN'S broth with the addition of ox serum or by the collodium sac method. A more minute study of this virus may be of help in indicating a line of research in the case of other diseases due to filterable viruses.

One must, however, in the first place, be quite sure that the organism in question actually is the cause of bovine pleuro-pneumonia. It has been stated that it is not (FREIBERGER—*Ztschr. f. Infekt. Krankh.* Vol. 12, p. 455), and that similar or rather identical bodies are to be seen in the blood-serum of healthy and diseased men and animals. To clear up this point cultures were made in serumized MARTIN'S broth. On incubation at 37°C. the medium became slightly and uniformly turbid after from three to five days; this turbidity could only be due to the presence of a large number of minute "bodies," and, knowing that injection of this culture into cattle will produce a local lesion similar to that produced by fresh pleuro-pneumonia lymph, the only doubt which can be entertained is as to whether the small bodies in the culture are actually the causal organisms or some product of these.

Microscopic examination of the cultivated bacilli with dark ground illumination showed them up as bright foci, but as the cedar wood oil behaved so as to produce images of other bright foci, it was discarded and pure distilled water used for immersion of the optical system. Under these conditions the bodies appeared to be, on the whole, round in shape; sometimes ring forms were seen and on occasion two or three bodies in a chain were seen. There was never any polymorphism to the extent of finding filamentous or branching forms. As to their motility, no definite proof of this could be established; the only movement actually observed was the ordinary "Brownian" movement common to all small bodies. Control material examined in the same circumstances did not show anything similar to the bodies described above. Small bodies were seen in sterile MARTIN's broth and serum, but they were quite dissimilar, resembling bodies also present in the cultures which were considered to be non-specific.

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* Abstracted by Mr. S. C. J. Bennett, B.Sc., M.R.C.V.S.

Having found a specific body, the question to be considered was as to whether it was the causal organism itself, or merely a reaction product. It was decided to attempt an agglutination test. A yearling bull was given 10 cc. of a 40 days' MARTIN's broth culture intravenously. No untoward result followed; in fact, there was absolutely no clinically apparent reaction, but after nine days the agglutinating titre of the bull's serum rose to 1–50. A heifer was also similarly treated but the material was injected subcutaneously at first. A considerable local reaction followed, with swelling up to the size of a man's head after about a week. This dose was followed by larger ones and even by pleuro-pneumonia lymph, but no further reaction was observed. Nine days after the last injection the agglutinating titre of the serum was 1–100.

The agglutination technique was as follows :—A pure culture in MARTIN's broth was taken—eight days' growth—and divided after shaking into portions of 5 c.c. in small sterile tubes. To these tubes were added on the one hand normal ox serum and on the other hand serum from the immunized animals in varying dilutions. One tube of non-serumized culture was used in each test as a control. The whole series was incubated for 24 hours and then centrifuged at high speed. In all the tubes the organisms were thrown to the bottom. The vital point of the test now followed; all tubes were shaken and the results were found to be as follows:—In the non-serumized control tube slight shaking mixed the deposit of organisms with the overlying liquid, forming a uniform turbidity ; the culture treated with normal serum behaved similarly, but that treated with serum of the immunized animals broke up only into a few coarse clumps. This phenomenon may be accepted as proof that the organisms demonstrated microscopically are the causal organisms.

Confirmatory phagocyte tests were next carried out. MARTIN's broth cultures were distributed in quantities of 2 cc. in small tapered centrifuge tubes, and to each tube the same quantity of a standardized emulsion of guinea-pig leucocytes (washed) was added. Series of these tubes were then treated on the one hand with normal serum and on the other hand with serum from the animals immunized against pleuro-pneumonia, whilst some were not treated with any serum, being retained as controls. All tubes were now incubated and examined after sedimentation of the leucocytes. It was noted that the tubes treated with immune serum had cleared considerably, while those treated with normal serum and the controls were as turbid as before. The organisms had been phagocyted in the presence of the "opsonins" of the specific immune serum. It was not possible to prove that the organisms were actually included inside the leucocytes since, owing to their minute size, they are extremely difficult to demonstrate in such circumstances, but their disappearance from the emulsion is sufficient proof.

It may be concluded that the results of these researches are very encouraging and it may be that in the near future one may overcome the alleged "ultravisibility" by some modification of the technique employed in these tests for agglutination. As to the practical application of the facts and results, numerous experiments on an extensive scale will be required to warrant any conclusion.

GINS (H. A.). **Versuche über die Vakzination der Schafe.** [Experiments on Sheep Vaccination.]—*Zeitschr. f. Hyg. u. Infektionskr.* 1920. Vol. 90. pp. 322–336.*

Early literature on the subject of sheep vaccination is both vague and contradictory. It has been held that treatment of sheep with true sheep lymph is dangerous, and as regards cow lymph, some authors advise and some deprecate its use. Passage of the bovine material through several sheep has been advised in order to increase its potency. Moreover, in any case the earlier experiments appear to have been insufficiently controlled, since the various methods of vaccination have only been adopted in times of necessity (*Notimpfung*) and virulent sheep-pox has been too prevalent on such occasions to permit of exclusion of natural infection. It was therefore considered to be not only desirable but even necessary to make further investigations; the political situation in South Eastern Europe makes the menace of sheep-pox less remote than usual.

The first series of experiments deal with the effect of vaccination of sheep with cowpox.

A sheep was inoculated on the body by scarification with ordinary glycerinized calf lymph. A local pox lesion developed, but there was no systemic disturbance or tendency to spread. From this lesion material was inoculated direct to another sheep and at the same time was tested on a rabbit by scarification of the skin and cornea. Both the second sheep and the rabbit developed local pox lesions and the cornea of the rabbit later proved to be rich in GUARNIERI bodies. From the second sheep material was inoculated on to a third sheep, and another rabbit, and here again the lesions were exactly as at the first inoculation. Thus neither inoculation with cowpox nor with "ovinized" lymph is dangerous as no systemic disturbance is set up, and there is no tendency to generalization either with bovine material, or material passaged through sheep.

Attempts to set up any form of local or general disease by means of inhalation (six experimental sheep) failed.

Experiments with sheep-pox material gave quite different results. A three months old lamb, still with its mother, was inoculated by scarification on the body. Swelling and inflammation set in at the seat of inoculation within three days, but even after seven days there was no sign of pustule formation. Simultaneously with the skin inoculation some material suspended in salt solution was injected under the mucous membrane of the lip and an extensive inflammation and infiltration developed around the point of injection; the mucous membrane began to separate on the seventh day. Systemically the lamb was depressed and off feed, but after shedding the mucous membrane of the mouth lesion, its good spirits and appetite returned (16th day). The material constituting the body lesion was removed on the ninth day showing the raw corium underneath. At this period there was no necrosis of the skin, and although this condition developed a few days later the necrotic skin was soon shed and the lesion healed completely.

The mother sheep showed no lesions or symptoms for 18 days, but at this period developed a most severe generalized form of pox—exanthema, photophobia, stomatitis, conjunctivitis—and at length died 11 days after the onset of symptoms. Post-mortem examination showed the usual acute lesions internally. This experiment is of great interest in that it demonstrates the different effects of experimental and natural infection with sheep-pox material.

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* Abstracted by Mr. S. C. J. Bennett B.Sc. M.R.C.V.S.

An inhalation experiment was performed with scab material from the sheep which succumbed. A sheep thus treated developed general symptoms, which first appeared in the 18th day and to which it succumbed on the 21st day.

A further series of experiments was conducted, embracing the sheep already used in the first experiment (vaccination with calf lymph and passaging of " ovinized" lymph). The experiments and results were :

1. Sheep which had received only glycerinized calf lymph inoculated with virulent sheep material. This sheep developed pox on the 8th day and died on the 14th day.

(NOTE.—The glycerinized lymph had been stored for a month and had lost some of its potency.)

2. Sheep which had a month previously received "ovinized" lymph of the first passage was now tested with virulent material. No symptoms were developed.

3. Sheep which had three weeks previously received " ovinized" lymph of the second passage, now tested with virulent material. A slight local exanthema developed which cleared up in about a week.

4. Sheep which had about six weeks previously received fresh calf lymph diluted 1 : 3 now tested with virulent sheep material. No symptoms beyond temporary local erythema.

5. Sheep which had five weeks previously received " ovinized" lymph of the first passage now tested as usual. This sheep developed symptoms on the 5th day and died on the 13th day.

A review of these few experiments affords some useful information. Glycerinized calf lymph and " ovinized " calf lymph both give immunity to sheep-pox. As seen above there was not sufficient protection in every case since two experimental sheep died of pox. This failure to protect may be referred to lack of potency in the material used in the first place. The first vaccination with calf lymph was not successful, but the lymph had been stored for some time (four weeks), but a similar experiment with *fresh* calf lymph, even in a dilution of 1 : 3, afforded sufficient protection. The fact that " ovinized " lymph failed in one case is not so easy of explanation. The material had undoubtedly lost some of its potency as was proved by experimental inoculation of the cornea of a rabbit ; a 1 : 50 non-glycerinized emulsion of the material produced only small localised necrotic areas, whereas normally a 1 : 400 emulsion will set up an inflammatory process involving the whole cornea. It seems therefore that calf lymph used in a fresh condition is the best material to employ and that " ovinization " tends to reduce rather than intensify its potency.

Attempts were now made to produce immunity by inhalation. Six wethers were used, with a seventh as control, and the inhaled material was from fresh cowpox lesions. After an interval of eight weeks all seven wethers were made to inhale virulent sheep-pox material. In the case of three of them, no symptoms of pox developed while three others developed small papules round the nostrils and muzzles which soon subsided ; the control sheep developed pox symptoms on the 16th day and died on the 20th day. It is therefore apparent that inhalation of fresh cowpox material confers a solid immunity against death from sheep-pox.

Further experiments were conducted in order to establish the value of skin vaccination with cowpox as a protection against inhalation of sheep-pox and *vice versa.* Sheep so treated appeared to be immune when tested, but owing to the age of the virulent test material even the controls did not die so that the results cannot be considered decisive.

A review of the whole series of experiments shows that cowpox is transmissible to sheep, but that even the most potent material will only produce mild symptoms. Again, vaccination of sheep with cowpox confers a solid immunity against subsequent infection with sheep-pox and the more virulent the cowpox material, the greater will be the immunity produced.

For the benefit of veterinary surgeons who may wish to adopt vaccination in practice it will be interesting to note also that the area of skin vaccinated appears to have some bearing in addition to the virulence of the vaccine. In these experiments four light surface cuts each about two inches long proved to be sufficient, but as to the minimum requirements no tests were made. The seat is preferably the body inside the fore leg, in the first place because any damage to the hide in the event of a severe reaction will be of little account, and secondly because there is not so much danger of soiling and secondary infection as would be the case if the operation were performed in the hitherto popular seat—at the root of the tail.

The good results obtained in immunisation by inhalation make one wonder whether this method could not be adopted on a large scale—say with a large spray in a sealed room. If such a course were adopted, care would have to be taken to allow all infected vapour to clear away or settle down before attendants were allowed to clean the chamber out; it is not known whether human beings react to inhalation of virulent sheep-pox. If the method were practicable it would be of immense value, since thousands of sheep could be treated in a single day—allowing, say, half an hour for each lot with a vapour made from one part of calf lymph to 20 of saline.

These experiments. although so successful in Germany, should, in order to be conclusive, be performed again in some country in which sheep-pox is enzootic.

GORDZIAKLOWSKI. **Note sur une nouvelle inoculation préventive contre la peste bovine.** [Note on a New Method of Preventive Inoculation against Cattle Plague (Rinderpest).]—*Rec. Méd. Vét.* 1921. Feb. 15–Mar. 15. Vol. 97. Nos. 3 and 5. pp. 115–116.*

The method advocated is based on the fact that organisms in many cases are attenuated by heat. During the course of an extensive outbreak of cattle plague in Poland the usually adopted measures were found to be inadequate; slaughter and disinfection could not be adopted on a sufficiently wide scale to produce good effects. Furthermore, the simultaneous serum and virulent blood inoculation was impracticable owing to lack of veterinary surgeons and general organisation. It was therefore decided to test the efficacy of blood from infected animals attenuated by heat.

The technique employed consisted in withdrawing blood from infected cattle in the "second stage," that is to say, when they showed fever and buccal lesions, but before the onset of diarrhoea. The blood was defibrinated and heated in shallow dishes at 55°C. for 10 minutes, and then at 48°–50°C. for an hour. As a preliminary test the dose of this heated virulent blood was fixed at 1 c.c.

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* Abstracted by Mr. S. C. J. Bennett, B.Sc., M.R.C.V.S.

The first experiment with the heated blood was performed on 28 cattle in an infected establishment, each of which was given 1 cc. (presumably subcutaneously). Nearly all of these cattle developed some fever—104°-105°F.—and three of them succumbed. These three deaths may be passed over lightly when it is remembered that they occurred in an establishment already infected with cattle plague ; the victims were probably in the incubation stage when first treated. The remainder recovered and were dosed with fully virulent blood after an interval of twelve days from the first injection. None showed any ill effects.

Another case is quoted in which 120 beasts in three establishments were similarly treated and none of these succumbed to the first vaccine.

The author concludes that virulent cattle-plague blood may be attenuated by the method described and successfully used as a first vaccine, to be followed later by virulent blood.

CURASSON (G.). **Les lésions cutanées dans la peste bovine et le rôle des peaux dans la transmission de la maladie.** [The Cutaneous Lesions of Cattle Plague and the Rôle of Hides in the Transmission of the Disease].—*Rec. Méd. Vét.* 1921. Jan. 15. Vol. 97. No. 1. pp. 19–26.*

Cattle plague has always been described as an acute exanthematous disease, but in the descriptions of most writers the skin lesions have either been disregarded or rapidly passed over. Furthermore, many authors regard any cutaneous eruption as exceptional, whereas Curasson in this article records his opinion that in all cases of rinderpest running a normal course they are the rule. The question is gone into in detail and a minute description of the lesions is presented as observed in a recent large outbreak of cattle plague in West Africa.

The lesions make their appearance in the second stage of the disease along with conjunctivitis, stomatitis and diarrhoea ; if they are not noticeable until later it is because at their development they were small and discrete. Small round red spots appear varying in number and proximity, usually in parts where the skin is thin and the hair fine ; sometimes they appear all over the body, but it is exceptional to see any lesion below the knee or hock. Where they occur, the hair stands on end in a manner similar to that observed in ringworm. Later, these lesions develop into papules and then pustules. The pustules then break, causing matting of the hair in the neighbourhood ; the appearance varies in detail according to the position and number of the lesions. Generally, the skin, now denuded of epithelium, has the same appearance as it would have following the application of a vesicant. Eventually the hair grows through slowly and covers the bare patch of skin ; and this new hair is in nearly every instance found to grow " against the grain " of the pre-existing hair. In some cases the animal is so badly infested with the skin lesions as to be rendered almost bald when the scabs fall off : in such cases the deeper layers of the skin are also invaded, and if the beast recovers, large hairless cicatrices remain.

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* Abstracted by Mr. S. C. J. Bennett, B.Sc., M.R.C.V.S.

Such are the lesions seen in cases running the ordinary course. In very acute cases, owing to the rapid death of the patient, they are often never developed. Similarly they are more rare in calves and yearlings because these immature animals are more prone to develop a hyperacute form of the disease.

The skin lesions of cattle plague are of considerable interest from a sanitary point of view and may be of great value in helping an inspector to estimate the danger or otherwise involved in transporting cargos of hides. An accurate estimate is, however, only to be made if one can differentiate the lesions referable to cattle plague from those caused by injuries of various kinds. In rinderpest hides, the lesions would usually show as fairly regular round areas up to a sixpence in size, with the hair growing in a different direction from that on the surrounding parts. Such areas would be found as a rule on the insides of the legs and the side of the neck. Larger areas of similar appearance might be seen along the back and on the croup. In hides from animals which had developed a general skin form of the disease, the hide would be irregularly pitted and the depressed areas would be hairless as if resulting from a burn or scald. Mistakes, however, can be made in attempting to decide whether a hide has come from a rinderpest case or not. The most common conditions which may lead to a wrong decision are as follows :—

The treatment of the carcase by native butchers leads to damage of the hides in many cases ; the dead beast may have been dragged along the ground and bare patches produced ; the size and position of these should guide the inspector. Again, there may be scars from old wounds or burns, but these should not present much difficulty. Skins dried too rapidly in the sun may become corrugated and subsequent handling will rub the hair off the raised parts of the hide ; this feature should not be confounded with cattle plague lesions, since the hide will give a clue in virtue of the parallel ridges and furrows. The most difficult lesions to distinguish are those found on hides from working oxen ; harness galls are often of the size and shape of true cattle plague lesions. One must be guided by their position, as there are certain well known positions for harness galls, and these in the main are not the positions for cattle plague lesions. " Heating " of hides due to bad curing may cause some confusion at first, and one needs to have a practiced eye to " spot " badly treated hides. Dry-rot, caused primarily by severe bruises immediately preceding death, will produce circular skin lesions, but here the periphery of the lesion is a dull reddish brown colour and in the process of tanning the centre of the lesion usually falls out, leaving a hole. Another distinguishing feature is that they are more easily seen from the inside of the hide. The ravages of insects need present little difficulty, since long narrow channels are easily seen and in nearly every case a short examination will reveal excrement or larvae of the causal insect.

The next point considered is the danger of these hides as a possible source of infection. The author is of opinion that the importance of this point has been universally exaggerated. It is claimed that no case of cattle plague in French West Africa has been definitely traced to contagion from the hides of infected animals (the author's observations from 1915–1918), and it seems probable that the infective period of hides is short and the danger of their spreading the disease is small unless they are transported immediately after flaying a fresh carcase. The author quotes an experiment in which he failed to reproduce cattle plague in a calf by inoculation of emulsion in normal saline of pieces of infected skin which had been exposed to the sun for four hours—the natives dry their hides by exposing them to the sun for several hours on two or three successive days. In addition to sun-drying the hides are, as a matter of routine, steeped in an arsenical solution to prevent the ravages of insects (potassium arsenate 2–3 per 1,000 for 12–24 hours).

In consequence, the French Ministry of Agriculture will allow the importation of dried hides into France provided thay have been sun-dried after steeping in the usual arsenical solution. For uncured hides they demand that before loading from Africa the hides must be treated with an efficient disinfectant—at present either 3 per cent. commercial cresyl, or 1/1,000 sublimate combined with 5/1,000 hydrochloric acid are used.

To sum up, the author concludes that the skin lesions of cattle plague are fairly typical and any reasonable treatment of infected hides removes all danger of spreading the infection.

REMLINGER (P.). **L'inoculation intrajugulaire de virus rabique chez le mouton et chez le chien.** [Intrajugular Inoculation of Rabies Virus in Sheep and Dogs.]—*Rec. Méd. Vét.* 1921. April 30—May 30. Vol. 97. Nos. 8 & 10. pp. 172–175.*

It has been stated that intrajugular injection of rabies virus should produce different effects in herbivora from those produced in other animals; in the latter rabies should develop, whereas in herbivora not only should the disease not develop, but a solid immunity should ensue. This divergence of results is due, according to HELMAN, to a difference in structure of the capillary blood vessels; those of herbivora tend to prevent the virus gaining access to the nerve centres whilst those of other animals have no such inhibitory power. The following experiments were instituted in order to throw some light on this hypothesis.

The first series of experiments were performed with nine sheep and eleven dogs, all of which received a dose of fixed virus of about the same size intrajugularly (from 5–10 c.c. of a milky emulsion.) The result was that, of the sheep two died and seven recovered, and of the dogs four died, five developed no symptoms and two developed symptoms but recovered. As there was no striking difference between the behaviour of dogs and sheep to the fixed virus, further experiments were performed with ordinary street virus.

For these tests brain material which killed rabbits in 20 days was employed; a one per cent. emulsion was prepared by trituration, roughly strained, and injected intrajugularly into 10 sheep and 10 dogs in doses varying from 2 c.c. to 10 c.c. The results are best shown, as in the original article, in the form of a table.

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* Abstracted by Mr. S. C. J. Bennett, B.Sc., M.R.C.V.S.

Sheep.	Quantity Inoculated.	Result.
1	2 cc.	Survived.
2	2 ,,	,,
3	4 ,,	,,
4	4 ,,	,,
5	6 ,,	,,
6	6 ,,	Died of rabies.
7	8 ,,	Died of rabies.
8	8 ,,	Showed suspicious symptoms, but recovered Afterwards immune.
9	10 ,,	Died of rabies.
10	10 ,,	Died of rabies.

Summary.—4 deaths, 6 survivals; deaths, 40 per cent., survivals, 60 per cent.

Dogs (all adult).	Quantity Inoculated.	Result.
1	1 cc.	Survived.
2	2 ,,	,,
3	4 ,,	,,
4	4 ,,	,,
5	6 ,,	,,
6	6 ,,	Died of rabies.
7	8 ,,	Survived.
8	8 ,,	Died of rabies.
9	10 ,,	Died of rabies.
10	10 ,,	Died of rabies.

Summary.—4 deaths, 6 survivals; deaths, 40 per cent., survivals, 60 per cent.

The first five animals of each series were subsequently tested as to immunity by inoculation of virus into the anterior chamber; all were found to have developed immunity. The result of the experiments therefore with the street virus, as with the fixed virus, showed no difference in its action on adult dogs or sheep. It was decided to extend the tests with street virus so as to include puppies, and a parallel series of 10 puppies received varying doses of street virus with results as follows:—

Puppy.	Quantity Inoculated.	Result.
1	2 cc.	Died of rabies.
2	2 ,,	Died of rabies.
3	4 ,,	Died of rabies.
4	4 ,,	Survived.
5	6 ,,	Survived.
6	6 ,,	Died of rabies.
7	8 ,,	Survived.
8	8 ,,	Died of rabies.
9	10 ,,	Died of rabies.
10	10 ,,	Died of rabies.

Summary.—7 deaths, 3 survivals; deaths, 70 per cent., survivals, 30 per cent.

The author regrets that circumstances did not permit of extending the experiments to young herbivora (lambs, kids, calves) or to other species of adult animals. Also it must be remembered that the only channel of administration of the virus employed was intrajugular injection.

The conclusion to be drawn from the tests as actually performed is that adult sheep and adult dogs are affected in exactly the same way following intrajugular inoculation with rabies. Further, the most careful histological examination of capillary blood vessels, whether of the nervous or other tissues (*e.g.*, respiratory), reveals no difference in structure. The only difference that may count is the *thickness* of the capillaries; the thinner the capillaries the more likelihood is there of virus permeating them. This may be the explanation of the higher percentage of deaths in the puppies as compared with the adult sheep or dogs.

TEPPAZ (L.). **A propos d'un cas de rage humaine au Sénégal.** [A Case of Human Rabies in Senegal.]—*Rec. Méd. Vét.* 1921. April 15. Vol. 97. No. 7. pp. 207–209.*

Considerable discussion has arisen at various times concerning rabies in West Africa. It has been stated that rabies does not exist there, and that rabies, although it is present in the country, is not communicable to human beings. It is certain that the disease has been given very little attention, since no authentic case of fatal rabies has hitherto been reported in a European; the natives appear to neglect it entirely, either through their natural apathy or in virtue of the disease in dogs usually assuming the form of so-called " dumb rabies."

The case reported in this communication is that of a European who was bitten by a dog on the right hand and right knee (on July 18, 1920). He was admitted into Dacca hospital (on August 30, 1920) suffering from " spasm of the larynx and oesophagus " and died the same day. It transpired that the dog had at the same time also bitten a small dog belonging to the patient. Some time after receiving the bite, the patient complained of acute pain in the right hand, but as his dog, which had also been bitten, appeared to be all right he paid no attention to it. Later, however, the small dog became indisposed and eventually blind and paralysed in one fore leg (August 15, 1920). Consequently it was destroyed.

The owner now wished to proceed to Dacca to receive anti-rabic treatment *but was advised not to do so because no case of rabies had ever been recorded in a European in Senegal!* As stated above, he died a fortnight afterwards, six weeks after having been bitten. That he actually died of rabies was confirmed by experimental inoculation of rabbits and guinea-pigs.

BOUFFARD (G.). **De la rage canine en Afrique Occidentale Française.** [Concerning Canine Rabies in French West Africa].—*Bull. Soc. Path. Exot.* 1921. Jan. Vol. 14. No. 1. pp. 6–9.*

Mad dogs have been known to exist in West Africa ever since the district was first opened up, but many authorities have doubted whether the symptoms are the result of true rabies or whether there is another disease with similar symptoms which is responsible. Natives known to have been bitten by these mad dogs have never developed rabies and information culled from reliable sources tends to show that human rabies is unknown.

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* Abstracted by Mr. S. C. J. Bennett, B.Sc., M.R.C.V.S.

Cazalbou was convinced that the disease was true rabies, an opinion with which the author agrees, and Teppaz in the course of his veterinary duties in Senegal (1919) confirmed his diagnosis of a case of rabies by experimental inoculation [*see* preceding extract]. A comprehensive study of rabies at Dacca led Heckenroth to conclude that true rabies is indigenous in West Africa and may be transmissible to man. He admits that the strains communicable to man may possibly be of recent importation, but can find nothing to prove that the local form of the disease may not be virulent for man in certain favourable circumstances.

The point at issue is that if there are two diseases, how may they be differentiated ? It is certain that the African form cannot be " fixed," but Heckenroth has remarked on the loss of virulence on the part of the European fixed virus sent direct to Dacca from the Pasteur Institute in Paris. On the other hand if there is only one disease how may one account for the differences in behaviour in Europe and Africa respectively ? It has been suggested that the change is due to the difference in physical environment in Africa—heat, dryness, intensity of light—but no definite conclusion has been reached.

The author, in the course of experiments with West African rabies, attempted experimental inoculation of rabbits and guinea-pigs with brain material from dogs which had become naturally infected and showed typical clinical symptoms of the disease. The experimental animals developed rabies and died. Passaging was also attempted, but although all the animals inoculated developed rabies, the virus never became " fixed." An interesting fact was established; the virus found in Dahomey would after several passages attain a greater degree of virulence than virus originating in the French Sudan, killing with certainty in from 16 to 18 days. Beyond this, nothing definite can be said; the author is of opinion that the only way to settle the discussion is to test the African virus in Europe alongside the European virus.

MISCELLANEOUS.

Kraus (R.) with Kantor (L.), Fischer (H.) & Quiroga (R.). **Ueber die Aetiologie der Meningo-Encephalitis epizootica (Bornasche Krankheit).** [Concerning the Etiology of Meningo-Encephalitis Epizootica (Borna Disease).]—*Zeitschr. f. Immunitätsf. u. exp. Therap.* Abt. I. Orig. 1920. Sept. Vol. 30. No. 2. pp. 121–143. With 9 figs.*

A comprehensive summary of previous work on Borna disease precedes the communication with regard to the authors' own research and mention is made of the multiplicity of opinion as to its etiology. The lack of macroscopic lesions and the characteristic histological alterations are taken as established features and it is particularly on the presence of the latter that the existence of the disease is confirmed. The accepted histological lesion is in the nature of an infiltration by lymphocytes of the perivascular lymph spaces of the smaller blood vessels in the grey matter of the brain and sometimes also of the spinal cord. Also according to JOEST cell-included bodies are to be seen in some parts of the brain.

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* Abstracted by Mr. S. C. J. Bennett, B.Sc., M.R.C.V.S.

The researches here described were instituted in order to ascertain whether intra-cerebral injection of brain substance of affected horses would reproduce the disease in experimental animals—primarily guinea-pigs and rabbits. The first experiment quoted is one in which brain substance from a horse which had shown Borna symptoms was injected subdurally into five rabbits. All died within 24 hours with no visible lesions on post-mortem examination. Subdural inoculation of more rabbits and guinea-pigs with their brain substance caused death in about three days. The same experiment with material from another horse produced the death of guinea-pigs and rabbits in 24 hours, but intraperitoneal inoculation was without any visible result. Material from a third horse killed rabbits in two days, while brain substance of sound horses and of horses dead or destroyed for other reasons caused no disturbance in control animals. Even material from horses with mal-de-caderas proved negative (an interesting point, since the brain shows lesions similar to those of Borna disease).

The total results of these direct transmission experiments showed that brain material from horses with the acute form of the disease will produce death in rabbits and guinea-pigs within 24 hours if injected intracerebrally. Subcutaneous or intramuscular injection was found to be less certain and the latent period more prolonged. Passaging from rabbit to rabbit or guinea-pig to guinea-pig is practicable with certainty intracerebrally and possible in many cases intramuscularly. In all cases when the experimental animals die there are no lesions appreciable to the naked eye.

Steps were next taken to attempt to demonstrate a causal organism, and it was found possible in every case to cultivate organisms from the brain substance, and in some cases from the blood, of rabbits killed by inoculation with brain material from infected horses. Material sown on agar plates and incubated at body temperature for 24 hours showed small colourless translucent colonies which at 48 hours became granular in the centre.

Microscopical examination showed that the cultivated organisms were cocci, easily observable in hanging drop preparations in which they executed lively "Brownian" movement, but they were difficult to stain. Prolonged staining (five minutes) with dilute fuchsine, LOEFFLER'S methylene blue, or aniline gentian-violet after warming revealed them as diplococci, in form not unlike meningococci but rather smaller. Sometimes cocco-bacillary forms could be seen. The organisms were definitely Gram-negative. Prolonged cultivation induced pleomorphism and the form became cocco-bacillary and then filamentous. Animal passage either through rabbits or horses, of the pleomorphic form, reproduced the original diplococcus.

Further observations showed that culture in broth produced turbidity and a slight film after 24 hours, the latter becoming a considerable scum after 48 hours; after some days a thready bottom growth appeared. Gelatine was not liquified, no haemolysis was observed in blood media, and acid was not produced in litmus-milk or neutral red media; sugars—lactose, mannite, glucose, and maltose—were not fermented and no growth occurred on Conradi-Drigalsky media.

The organism proved to be very susceptible to heat and common disinfectants—a temperature of 60°C. was fatal in an hour and a one per cent. solution of carbolic acid in 15 minutes.

The next essential step was to prove the pathogenicity of the organism. Rabbits, guinea-pigs and mice succumbed to intravenous or subcutaneous inoculation within two days (broth culture). Post-mortem examination revealed no lesions in these experimental animals beyond distention of the bladder, but the diplococcus could be recovered and cultivated from the brain substance or the blood. The virulence of the organism was very high, so that as small a dose as 0·001–0·0001 cc. of a two days' broth culture proved fatal intravenously after two to four days in the case of rabbits. To retain any considerable degree of virulence it was found necessary to transplant the broth cultures every three or four days, but even when this precaution was observed the virulence showed a steady decline. Similar results were observed when broth cultures of the diplococcus were injected into larger animals—goats, sheep and calves. Small doses were fatal subdurally, but larger doses (5 cc. for a goat) were necessary if given intravenously.

The most important inoculation experiments — with horses — gave similar, but not identical, results. Cerebral inoculation reproduced the disease with great certainty, whereas intravenous administration was extremely uncertain ; the horses often developed no symptoms by the latter method. Of eight horses inoculated intracerebrally, all died within periods varying from two to eight days, and the organism was recoverable from the brain substance and cerebro-spinal fluid. Of the same number inoculated, intravenously, only two died and from neither of these was the organism recoverable. Subcutaneous injections of large quantities of culture were negative.

The facts that two horses had died following intravenous inoculation and that the organisms had not been recoverable, suggested the possibility of toxic action. Further experiments with filtrates were, however, all negative.

Control experiments were performed with other organisms. Horses were inoculated subdurally with cultures of *B. coli*, Streptococcus and Meningococcus. The results were that both *B. coli* and the meningococci proved fatal. Post-mortem examination, however, was not macroscopically negative as is the case in Borna disease. In both cases meningitis was produced, but that due to *B. coli* was seen to be quite distinct from the disease under consideration. There was hyperaemia of the brain vessels and considerable increase in the number of leucocytes, but no perivascular lymphocyte infiltration. In the case of the meningococci a purulent meningitis supervened.

As a result of the above experiment, the author and his collaborators conclude that the diplococcus which they isolated, which they call the " diplococcus of enzootic encephalitis," is the cause of Borna disease, their argument being that it can be isolated from the brain substance of horses which have acquired the disease naturally, it may be cultivated, it may be passaged, it will reproduce the symptoms and lesions of the naturally occurring disease when injected into horses subdurally and it is recoverable from the brain substance of such experimentally infected horses.

JOEST (E.). **Einige vergleichend-pathologische Bemerkungen über Encephalitis lethargica.** [Some Comparative Pathological Notes on Encephalitis Lethargica.]—*Zeitschr. f. Infektionskr. etc. der Haust.* 1920. July. Vol. 21. Part 1. pp 97–99.*

In human pathology there has recently been considerable mention of encephalitis lethargica, which has been appearing sometimes sporadically and more often with the characters of an epidemic. Generally speaking, it is characterized by symptoms of inflammation of the brain, accompanied often by those of inflammation of the spinal cord. The most striking feature is a tendency to sleep.

Examination of the brain in fatal cases presents no macroscopic alterations, but histologically the appearance of a nonpurulent inflammation is recognized. The adventitia of small vessels is infiltrated with small cells, mainly small mononuclear leucocytes, accompanied by a few plasma cells. The alterations are confined to the grey matter of the brain—and sometimes also of the spinal cord.

In many instances the disease seems to have some connection with influenza, but is probably not identical with the latter.

Human encephalitis lethargica is of interest from a veterinary point of view in that the horse is attacked by a similar disease in which the clinical symptoms and histological features of the brain correspond very closely; this is "Borna disease" or encephalomyelitis enzootica equi. In fact, both conditions are very similar to sleeping sickness due to trypanosomes, both clinically and histologically. It is not known whether the desire for sleep in these three diseases is due to a specific toxin or merely to pressure applied by the infiltrated and thickened vascular adventitia. Probably the former is more likely, seeing that there is no tendency to sleep in rabies where the lesions of the brain are somewhat similar.

It might be considered from the foregoing remarks that human encephalitis lethargica is one of a group of diseases of the central nervous system which could be grouped as "encephalitis (or encephalomyelitis) lymphocytaria." Other members of this group would be rabies, fowl plague, canine distemper (nervous form), infantile paralysis and human sleeping sickness. So far human encephalitis lethargica appears to be a disease *sui generis*, but it would be interesting to pursue the histology farther; in particular to determine the presence or absence of cell inclusions comparable with those found in most of the diseases above mentioned.

NICOLAS (Ch.) **Résultats de dix années d'observation du** ***big head*** **en Nouvelle-Calédonie.** [Ten Years' Observation of Big Head in New Caledonia.]—*Bull. Soc. Path. Exot.* 1921. June 8. Vol. 14. No. 6. pp. 337–339.

This author has already written a number of short articles on this subject, but does not appear to have as yet elucidated the problem satisfactorily. He maintains that big head is a particular form of osteoporosis, which is quite different from true osteomalacia, inasmuch as it is contagious, although its morbid anatomy shows some degree of resemblance with that of the latter condition.

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* Abstracted by Mr. S. C. J. Bennett, B.Sc., M.R.C.V.S.

In New Caledonia the disease affects exclusively horses, of all ages. A few months' association with diseased animals seems to be sufficient to infect healthy subjects. Big head is a bilateral tumour of the lower jaw and may be differentiated on clinical grounds from osteomalacia, inasmuch as this condition is not contagious, and it rarely affects foals, and even though it may sometimes attack the lower jaw, it can be observed also affecting all the bones, and particularly the limb bones near the joints. A young animal affected with osteomalacia may also be attacked simultaneously with big head, but big head doess not necessarily affect all foals attacked with osteomalacia. Cattle—calves and young animals—may also be affected with osteomalacia, but they are never attacked with big head. Again, while osteomalacia seems to be due principally to a lack of or incomplete calcification of the bones, brought about by a deficiency of calcium in the food and especially in the maternal milk, big head appears to be caused by the action of a filterable virus. However, experimental proof of this assertion is not forthcoming. Absence of chalk in the soil, foodstuffs, and drinking water, appears to be a condition which favours the development of big head. In osteomalacia there is no satisfactory treatment, but big head seems to be amenable to treatment by the local application of an ointment and daily addition of an ounce or two of chalk to the drinking water.

EVANNO. **Cas de coryza gangréneux chez le Buffle.** [A Case of Gangrenous Coryza (Malignant Catarrh) in the Buffalo.]—*Rev. Path. Comp.* 1921. Mar. 5. Vol. 21. No. 178. p. 107.

The author, a veterinary inspector in the Sanitary Service at Cambodia (French Indo-China), observed among buffaloes several cases of malignant catarrh, and the diagnosis appears to have been confirmed by another veterinary inspector. According to MOUSSU and NOCARD and LECLAINCHE, this disease has not yet been observed in the buffalo, and it is described as a general infectious disease peculiar to the ox. The affection observed in the buffaloes was manifested in two forms, viz., (1) respiratory and (2) exanthematous, with no lesions on the pituitary mucous membrane or in the respiratory tract, but characterized simply by the presence of pustules on the whole body, and eye lesions. An important point was that these buffaloes lived in close proximity with cattle, none of which became infected. It is considered that the term coryza is defective, inasmuch as some of the animals did not show any signs of coryza.

CROVERI & SALVESTRONI (P.). **Observation sur l'hématologie normale et pathologique des bovidés de la Somalie italienne, spécialement considérée par rapport à la peste bovine et aux trypanosomiases.** [The Normal and Pathological Condition of the Blood in the Cattle of Italian Somaliland, considered particularly in its Relationship to Rinderpest and the Trypanosomiases.]—*Rev. Path. Comp.* 1921. March 5. Vol. 21. No. 178. pp. 105–107. [Summarised by M. FORGEOT.]

It is well known that the rinderpest virus resuscitates certain latent infections such as, for example, piroplasmosis, and thus the blood of a virus-producing calf may show nothing abnormal at the time of inoculation, but during the course of the disease set up by the injection piroplasms appear in the blood (usually on the fourth day) and the virus carrier hence cannot be utilized for the hyperimmunization of cattle. It would therefore be of interest to ascertain if there are any methods by means of which these latent infections of the virus-carrier could be revealed. The above authors found that a systematic examination of the gland juice obtained from the pre-scapular or inguinal glands was a very good method.

In Italian Somaliland the infective agent that most often appears following upon the injection of rinderpest virus is a trypanosome, and it was found that the disease could be diagnosed in the early stages by gland puncture. Moreover, animals affected with trypanosomiasis exhibited a characteristic leucocyte formula.

The composition of the blood in normal zebus of every breed, of both sexes, and of every age, was first examined, and in particular animals employed as virus or serum producers (that is, animals from 12 months to three or four years old). It was found that the number of red corpuscles was substantially the same as in European cattle, but the number of leucocytes was slightly higher than in the latter. In animals affected with rinderpest the authors obtained figures which were slightly different from those published by BALDREY and REFIK BEY, and this discordance may be explained by the difference in localities in which the results were obtained.

Whereas Croveri and Salvestroni made their observations near the Equator at sea level, BALDREY worked on the Himalayas at an altitude of 2,500 metres. BALDREY and REFIK noted an increase in the leucocytes at two different periods, viz., (1) commencing 24 hours after experimental infection and reaching its maximum after two or three days, and (2) commencing on the sixth day, when the number of leucocytes had appreciably diminished. The Italian authors on the other hand, noted a perceptible diminution commencing on the second day and this decrease became more and more marked up to the time of death; in cases of recovery the decrease was maintained only up to the ninth day, and subsequently there was a gradual but very slow increase in the number of leucocytes, which did not resume their normal count until well after recovery.

Likewise the leucocyte formula showed variations which ran parallel with the variations in number of the leucocytes. The decrease affected exclusively the lymphocytes, it sank to half on the fifth day, and dropped to a quarter of the normal number just before death. The neutrophile polynuclears increased and the increase varied directly with the decrease in the number of lymphocytes. The eosinophile polynuclears diminished considerably and then disappeared towards the fifth day. Thus the Italian authors share the belief of a number of authors (NICOLLE, ADIL BEY, and others) who consider that the virus resides in the leucocytes and it is suggested that it is perhaps in the lymphocytes that it is mainly to be found. In this manner may be explained the failure of certain workers to filter the virus at the commencement of the disease, whilst it is still enclosed within the leucocytes, whereas it is filterable later, when as the result of the destruction of the white corpuscles it is liberated into the blood stream.

In trypanosome affections a marked diminution in the number of red corpuscles is noticeable (from 7,549,088, the normal figure, down to 4,260,000), a decrease which is never seen in a pure rinderpest infection. With regard to the leucocyte formula there is an increase in the lymphocytes. In their original paper the authors supply a table illustrating the leucocyte counts in rinderpest complicated with trypanosomiasis. As in the trypanosomiasis, the authors found that in sarcosporidiosis there was a considerable diminution in the number of red corpuscles, and an appreciable diminution in the leucocytes. Tables are also furnished showing :—

1. The average corpuscular count in normal animals ;
2. The number of red corpuscles, leucocytes and leucocyte formula in rinderpest, from the first to the fifth day of the affection in cases of recovery or fatal termination ;
3. Like figures for fatal rinderpest ;
4. Like figures for non-fatal rinderpest ;
5. Like figures in pure trypanosomiasis ;
6. Like figures in rinderpest complicated with trypanosomiasis ;
7. Formulae in sarcosporidiosis ;
8. Formulae in other parasitic diseases ; and
9. A summary and comparative table showing the state of the blood in these infections.

MICHIELS (Fernand). **Diverses agonies due au tartre stibié.** [Toxicity of Tartar Emetic.]—*Arch. Internat. de Pharmacodynamie et de Therapie.* 1920. Vol. 25. Nos. 3–4. p. 217.*

Tartar emetic is used in increasingly large quantities throughout the tropics. It is particularly valuable in the treatment of bilharziasis, leishmaniasis, and trypanosomiasis. It is generally given intravenously. The work under consideration was undertaken at Louvain University as the result of a request by the doctors of the Belgian Congo, that investigations regarding the toxicity of the drug might be carried out with a view to obtaining knowledge whereby the occasional fatalities due to the poisoning of extra-susceptible patients undergoing antimony treatment might be avoided.

The research was carried out with the aid of rabbits, and Michiels refrains from arguing that by analogy the results so obtained therefore apply to human beings and domestic mammals. Nevertheless, the clinical experience gained in the field by veterinary surgeons at least supports such an analogy, and the effects of overdoses on rabbits resemble the toxic symptoms frequently presented by horses and cattle treated for trypanosomiasis.

The author gives a brief account of previous work by others. Very interesting are the experiments of MASOIN, who showed that antimony given intravenously disappears from the blood a minute later. Various investigators have described how, after it leaves the circulation, the drug is fixed by all the tissues, but particularly by the liver, and, to a less extent, the spleen. Elimination of the drug is by way of all secretions and excretions, but principally through the alimentary canal. This last explains the colic and diarrhoea which one meets with in practice in some animals undergoing a long course of treatment.

Administration of a *single* dose which is over the limit of safety—a dose, that is, between 1 and 2 cgm. per kilo bodyweight, causes death after some hours or even days by paralysis of the respiratory centre. The consequent dyspnoea and diminution of respiratory volume are accompanied, if the animal lives for more than a few hours, by loss of weight and general depression.

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* Abstracted by Capt. H. E. Hornby, O.B.E., D.V.S.M., M.R.C.V.S.

If one gives a lethal amount of the drug in the form of *several doses* at frequent intervals, death is brought about by hypotension due to vaso-dilatation (absence of adrenalin or paralysis of the medullary centre controlling vascular tone).

A third cause of death, which may supervene almost immediately after the injection of a toxic dose, is convulsive shock due to the poisoning at the same time of both the respiratory and vaso-motor centres.

An encouraging feature of antimony medication is the absence of drug accumulation in all cases except those to which doses approaching the toxic have been given at intervals of less than two or three days. Provided one allows an interval of not less than about three days to elapse between them, one can give for an indefinite period doses each of which is half the toxic one.

On account of this affinity of the drug for nerve centres it is difficult to prescribe an antidote for cases of poisoning by it.

Even medicinal doses cause albuminuria, but not jaundice.

After a week's heavy medication the liver may show lesions of fatty degeneration, but these are rarely severe.

SULDEY (E. W.). **Procédé simple de préparation d'un éosinate de bleu Borrel pour les colorations hématologiques.** [A Simple Method of preparing an Eosinate of "Borrel's Blue" for the Staining of Blood Preparations.]—*Bull. Soc. Path. Exot.* 1920. Mar. Vol. 13. No. 3. pp. 205–206.*

The method of preparation of this stain, which is very simple, is as follows :—

a. Mix together 100 cc. of fresh ripe Borrel's blue and 50 cc. of 1 per cent. aqueous eosin. Allow to stand for from 6 to 12 hours.

b. Filter, retaining the precipitate and allowing it to dry thoroughly in the open air.

c. Grind up the precipitate with 150 cc. of 90 per cent. or 95 per cent. alcohol ; leave open for 48 hours and agitate occasionally.

The stain is now ready for use, but should be kept in amber-coloured bottles. The dry precipitate may also be stored if a perfectly dry receptacle be used.

It may be necessary from time to time to reinforce the "basic staining" of the alcoholic solution ; this may be done by adding either one or two cubic centimetres of Borrel's blue or a mere trace of solid sodium carbonate.

The method of staining is as follows :—

a. Put three to five drops of stain on the *unfixed* blood smear and allow to act for one or two minutes, guarding meanwhile against evaporation.

b. Pour on 30 to 50 drops of water (distilled) and mix thoroughly. [This may be replaced by just shaking off the remains of the alcoholic solution and pouring on the requisite quantity of a 1 in 20 solution.] Allow to act for 10–15 minutes.

c. Wash in distilled water.

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* Abstracted by Mr. S. C. J. Bennett, B.Sc., M.R.C.V.S.

Differentiation, if required, may be effected by prolonging the washing until the smear is distinctly pink in colour, or by treating as required for a few seconds with a 1 per cent. solution of tannin.

NOTE. In the absence of Borrel's blue, the carbonated blue of STEPHENS and CHRISTOPHERS may be substituted, or MANSON'S borax blue may be employed, using the latter in equal parts with the 1 per cent. eosin solution.

MOTAIS (F.) **Nouvel éosinate de méthylene.** [A New Methylene Eosinate.]—*Bull. Soc. Path. Exot.* 1920. Mar. Vol. 13. No. 3. pp. 206–8.*

This stain is produced in order to replace those of LEISHMAN and GIEMSA, which, when they are not to hand ready-made, are very difficult to reproduce. The method is as follows :—

Methylene blue ((Höchst medicinal)	1·0 gm.
Eosin (Höchst)	0·4 ,,
Methyl alcohol	40 cc.
Ethyl alcohol (absolute)	80 ,,
Glycerine	3 ,,
Fontana's ammoniacal silver nitrate solution	3 ,,

Dissolve the methylene blue and eosin in the methyl alcohol and add the absolute alcohol, and then the glycerine drop by drop. Finally, add Fontana's solution. Boil for a few minutes on a water bath, stirring continuously, allow to cool, and filter. The stain is now ready for use.

Fontana's Solution.—This is prepared by placing a quantity of a 50 per cent. aqueous solution of silver nitrate in a measuring glass and adding *liquor ammoniae* gradually, stirring meanwhile. A brown precipitate forms, which grows darker, and eventually clears up again. When it commences to re-dissolve the ammonia solution must be added very carefully. The liquid is of the required constitution when a distinct but faint opalescence is reached ; it must not become water-clear, but if by accident too much ammonia is added, one may retrieve the error by adding a few drops of silver nitrate solution and adjusting to the degree of opalescence required.

Staining Technique.—An unfixed smear is placed in a Laveran-Mesnil capsule and 15 drops of stain poured on and left for a minute. The slide is now turned face downwards and 15 cc. of distilled water added. The resulting stain is shaken slightly to mix and allowed to act for 5, 10 or 15 minutes as required. Finally, the preparation is washed and blotted and may be differentiated if required with clove oil.

By this method it is claimed that quite intensive staining is to be obtained. The stock bottle should be kept tightly stoppered owing to the extreme volatility of the methyl alcohol. Further, although dyes by Höchst are recommended, there is no reason why eosin and methylene blue from other sources should not be serviceable.

REPORTS.

RAINEY (W.). **Live-Stock Industry in Fiji.**—*Agric. Circular issued by the Department of Agriculture, Fiji.* 1920. July. Vol. 1, No. 7. pp. 119–132. 1920. Suva: Govt. Ptr.

The approximate numbers of livestock in Fiji are :—Cattle, 80,000; horses and mules, 10,000; sheep, 1,000; goats, 6,000; and pigs, 4,000. The annual birth-rate of cattle is estimated at 10,000; the number killed for meat or exported, 4,500; number of deaths from old age, disease, and Fijian slaughter 3,500; leaving a net annual increase of 2,000 cattle. The supply of meat at present exceeds the demand, and consequently the price to the grower is low, but there is not a sufficient excess at present to supply a large export trade. In view of the cost of clearing, cultivating, fencing and weeding, it is not profitable for Europeans, at the present price of beef, further to develop land for cattle production except as a sideline on cocoanut plantations. The supply of cattle is kept up and increased by the Indian smallholder, who, on an average, has two cows and two working bullocks. The average weight of a three to four yearold bullock in Fiji is from 300 lb. to 400 lb., and the average price per beast is £7 10s. at Suva, or £6 5s. at Lautoka. The average carrying capacity of the best flat land in the wet belt of Fiji is one beast to the acre. The only profitable form of cattle farming for the European grazier would lie in the purchase of mature cows and store bullocks from the Indians for fattening purposes. At present the only successful self-supporting grazing farms are found on river flats in the wet belt with Para grass for pasture. The scope for more graziers is therefore limited, and there is much danger from overstocking, for when this grass is eaten down weeds and worthless herbage grow in abundance. It would be difficult at present to make a success of cattle farming in the dry belt on account of the low market rate set on store cattle by the Indian smallholder and the small number of areas available for fattening without handfeeding.

The position is, therefore, that there is a fairly good opening for a few good graziers with capital, provided they can secure first-class riverside flat-ground growing Para grass in the wet belt and that so far as the profitable breeding of cattle as a self-supporting industry is concerned, there is no opening at all. It is not likely that the Islands can compete in the world's market on level terms with temperate climate countries in the export of butter. There is, however, good reason for assuming that the percentage of butter-fat in the milk obtainable from a cow is actually higher than that which could be obtained from a similar class of cow under similar conditions of feeding in temperate countries. One enterprising commercial firm has built up an important trade in the victualling of ships with fresh meat, and has in hand the experimental breeding of Indian cattle on a large scale. The great value of Para grass (*Panicum molle*), when scientifically handled, has also been experimentally established. Practically the only export trade of live animals from the Colony is the shipment of a few bullocks each month to butchers at Tonga and Samoa, and there are numerous difficulties in the way of establishing an export trade with Australia.

Remarkably small progress has been made in the cultivation of good grass. At present the only payable pasture is Para grassgrowing on alluvial land. The cultivation of Paspalum grass does not appear to have met with success. The grasses best suited to local conditions are likely to be those of the Panicum family. With the exception of a small-leafed trefoil, Para grass, Guinea grass, and an upland variety of Panicum in the dry belt, there appear to be no grasses growing and propagating naturally in Fiji that are worth cultivating. Buffalo grass has been introduced experimentally and appears to do well. Rhodes grass is also being tried. Sensitive grass is useful in some places as a supplementary feed, but in other places cattle refuse to eat it.

As the result of Rainey's investigations, the following proposals have already been given effect, viz. :—

(*a*) An Ordinance to regulate the transport of cattle by water.

(*b*) An Order in Council making adequate regulations under the Foreign Animals Importation Ordinance to safeguard the Colony against the introduction of animal diseases.

(*c*) Regulations for the humane slaughtering of cattle.

(*d*) The declaration of tuberculosis as a contagious and infectious disease of cattle.

(*e*) Arrangements for establishing a quarantine station for animals at Suva.

Proposals which may require new legislation, to which effect has not yet been given are, :—

(*a*) An Ordinance to regulate the Overland Transit of Cattle; persons intending to travel cattle overland from one district to another should be compelled to obtain from the police a waybill, which would be checked and countersigned at each police station *en route*. This Ordinance would avoid any confusion that might arise concerning the identity of the travelling cattle and other animals, the property of persons on the trade routes.

(*b*) An Ordinance to provide for the Registration, etc., of Proprietors of Gates (large areas of foot-hill land appropriated for native cattle runs). The owner of the Gate receives cattle as boarders on payment and the object of the Ordinance is to prevent fraud.

Certain proposals are made which may require the amendment of existing legislation and regulations :—

(*a*) In Ordinance No. 21 of 1909 (Stock Improvement Ordinance of 1909), it is recommended to delete all reference to bulls, as at present there is no sound reason for selecting bulls by enforcing castration and it is not practicable at present to establish State-owned bulls for the use of the public.

(*b*) Importation of cattle from New South Wales, Victoria, and South Australia, ought to be sanctioned in the case of pure-bred breeding stock, provided they are submitted to veterinary inspection on arrival, quarantined for 14 days, and sprayed twice at intervals of 10 days during that period with a reliable arsenical dip.

(*c*) Infection of dogs with *Filaria immitis* should be declared an infectious and contagious disease under the Contagious Diseases (Animals) Ordinance, in order to give the Government Veterinary Officer power to destroy badly affected animals in the later stages of the disease.

(*d*) The Government should bear the cost of sea freight in respect of pure bred entire horses, cattle, and sheep, imported for *bona fide* breeding purposes. Pure bred cattle from India and jack asses from Spain should be included.

(*e*) The maximum compensation for the slaughter of a diseased beast should not exceed £3.

Proposals, which may not require legislation, are made (*a*) with reference to the appointment of a second veterinary officer for duty at Lautoka, and (*b*) having in mind the mortality that occurred in Mauritius, due to the importation of surra-infected animals from India, imported Indian cattle should be very carefully observed, and a dog should be inoculated with blood from each imported animal as soon as convenient after landing.

(*c*) All cattle should be inspected annually and infected herds inspected quarterly; all animals showing clinical symptoms of tuberculosis should be slaughtered.

(*d*) Every encouragement should be given to the promotion of agricultural shows or exhibitions of live stock.

In former reports certain proposals were made, but the author now adduces reasons for the abandonment of these proposals. Among these are those having regard to (1) the establishment of Government-owned bulls and stallions at various centres for the use of the public; (2) the establishment of a Government Stud Farm or Stock Farm for breeding pedigree stock; (3) the administration of the Stock Improvement Ordinance of 1909 by means of Committees in Districts; and, (4) the appointment of part-time lay stock inspectors in the country districts.

ANIMAL DISEASES.

Tuberculosis.—This disease is found in cattle throughout the Islands, and the degree of infection is favoured particularly in those districts where there is shade of trees and dense herbage, heavy rainfall, neglect in destroying diseased animals, overstocking or close stocking, and herding in large numbers. It is estimated that the incidence varies from 2 per cent. in some parts of the dry belt to 20 per cent., in some parts of the wet belt. Certain herds that have been neglected show a considerably higher percentage. In the wet belt the disease affects chiefly the lungs; in the dry belt it runs a more chronic course and is often found affecting the pharyngeal, prescapular, precrural, and inguinal glands, the udder rarely, and the subcutaneous tissue of the brisket. Little trouble is anticipated in controlling the disease among cattle on Indian smallholdings, as the Indian smallholder zealously prevents his cattle from running with those of his neighbour.

Nodular worm disease.—This affection appears to be distributed everywhere throughout the Colony and its ill effects appear to be limited to the following circumstances:—(1) it may give the final blow to overstocked, emaciated, or very weak animals; (2) it causes a chronic diarrhoea in badly affected animals so that they cannot be fattened; and (3) it is unable to obtain a hold on healthy, well nourished animals.

Ulcerating tumours of the eye and back of cattle and legs of horses.—An account of this condition appears to have been furnished in a previous report by the author, and he now adds "that further investigation may show the exciting cause to be a larval nematode worm, thereby establishing a relationship to a similar condition in Samoa termed 'Tona.'" The Government Veterinary Bacteriologist of New Zealand, REID (H. E.), in a recent report on a visit to Samoa, stated that "Tona" is due to wound infection with the larva of a parasitic worm [apparently Habronema, the larval form of which is now held to be the cause of summer sores, bursati sores, habronemic granulomata, etc.—ED.].

A few cases of actinomycosis in cattle have been observed.

Horses bred from Clydesdale or Shire strains are susceptible to greasy legs.

Strangles is introduced from time to time in shipments of horses from Australia and New Zealand, and its incidence appears to be limited by the extent of infection from this source. It does not tend to become enzootic in Fiji, or to cause serious symptoms in infected animals. Consequently it suffices to apply quarantine restrictions only to actually diseased animals arriving by sea.

Filariasis of dogs.—This disease is distributed everywhere throughout the group. It has been suggested that an island situated as Taveuni is, might free itself for some time from the disease by (1) destroying on a given date all the dogs on the island and forbidding the landing of any dogs from any Pacific Islands thenceforth; (2) restocking the island, after six months, with dogs imported from New Zealand or Australia. It is thought likely that during the interval of six months all the insect life on Taveuni carrying infection would become clean, and that the Island might remain free from the infection for a considerable period. However, on the other hand, it is possible that clouds of mosquitoes might be carried by certain winds from other islands and cause failure. At all events a considerable degree of success is likely to attend such a measure, for even although a few mosquitoes might be introduced from time to time with ships, the filaria would not be readily re-established in this manner. Individual dogs may be kept free from the disease by protecting them from mosquito attack in various ways, but few people are likely to take the trouble to ensure the success of such a measure. Many fantastic views are current in Fiji regarding the alleged virtues of several remedies as the destroyers of *Filaria immitis* in dogs. It is pointed out that recent research work carried out in Queensland by direction of the Australian Institute of Tropical Medicine has proved that the worm may be conveyed from one dog to another by the agency of fleas. In order to protect dogs with certainty, however, it would be necessary not only to make their sleeping quarters mosquito proof but also to keep the animals free from fleas by dusting them regularly with pyrethrum powder and periodically washing the kennel with a solution of corrosive sublimate, 1 in 300.

Mange.—Appears to be found only affecting horses in the dry belt, and it seems to be only slightly contagious as compared with the disease in other countries. Consequently there should be no great difficulty in stamping it out.

Scour in calves.—This disease is limited to areas and herds where the feeding arrangements are inadequate or where the land is overstocked.

Osteoporosis in horses.—Is found affecting a considerable proportion of all horses that have been running on Para grass from the time when they were foals, and the incidence of the disease is absolutely restricted to such circumstances. The naked eye symptoms are usually a bulging enlargement of the bones of the face and a general appearance of unthriftiness. In more advanced cases there is stiffness of gait or even paralysis of one or more legs. "There are few diseases of which the cause has been more disputed, but it seems proved that the form of the affection in Fiji is due to a deficiency in Para grass growing on alluvial flats of some element required for the growth and maintenance of bone in horses. This element may be lime or it may be a vitamin . . . . in practice the disease may be prevented by feeding a daily ration of cow-pea to each young horse running on Para grass. A ration of molasses also acts as a preventive."

Debility and malnutrition of cattle.—These conditions are widespread in Fiji and are the inevitable result of overstocking, underfeeding and running cattle on land where the pasture has little feeding value. The immediate effect is emaciation, but the ultimate result is the degeneration and dwarfing of all stock subjected to this circumstance. The Stock Improvement Ordinance of 1909 was passed, in so far as it provided for the castration of bulls, on the assumption that lack of attention to the matter of breeding was chiefly responsible for the degeneration of cattle, but Rainey's investigations appear to prove that under-feeding is by far the most important factor.

The future of the cattle trade in Fiji depends upon the following factors :—

1. Practical demonstration on a sufficient scale that hill land in the wet belt of Fiji will produce permanent pasture that will pay for weeding.
2. The discovery of suitable grasses for upland pasture.
3. In proportion to the grazing value of certain lands the cost of clearing, fencing, planting, and draining those lands and keeping them free from *Clidemia hirta* and other noxious weeds.
4. The establishing of a remunerative opening by means of a freezing or canning factory whereby Fiji may have access to the world's markets.
5. Creation and improvement of roads.
6. The amount of suitable land in fair sized lots conveniently situated as regards means of communication, which will be readily available for sale or long lease to intending graziers at reasonable cost.
7. The practicability ultimately of applying a Noxious Weed Ordinance to *Clidemia hirta.*

For a proper understanding of the pastoral problems of Fiji as compared with Australia, it must be realised that cattle ranching on a free and easy ring-fence or a boundary-riding basis is quite impossible. Large areas of good natural grazing, which make big scale ranching profitable in other countries are not found in Fiji. Dangerous bog, impenetrable forest, sterile hill land, entirely innutritious grasses, and other adverse features are inseparable from any considerable stretch of country in Fiji. It has to be noted, however, that these Islands are remarkably free from cattle diseases, and the author is convinced that under proper conditions of feeding and farming generally, cattle will thrive as well in Fiji as in any other country. A cross between the Zebu (Indian ox) and a European strain of cattle is most likely to prove the best breed for Fiji, except for high grade dairy farming, for which purpose a pure strain of Holstein is likely to give the best results. The half bred zebus have certain advantages in a tropical country inasmuch as they make by far the best working oxen, and are much more resistant to disease and better able to withstand adverse conditions of care and feeding than other breeds. The dry belt, although it affords no hope of further development for cattle, still holds forth good prospect of development as a sheep country, but further investigation is needed to establish whether ewes are profitably fertile in Fiji. The commercial prospects of pig-production could not be ascertained. Much hope of success is anticipated from the Dairy Scheme which has been established in Tailevu.

As regards horses, it is considered that Fiji can supply herself with both horses and mules provided reasonable care is observed in the breeding and feeding of foals. Draft horses are chiefly in demand, and these should be bred from the Suffolk Punch or Percheron strains. The best pasture for horses is the trefoil and mixed herbage found in the mountain valleys and some uplands in the dry belt. However, it may be found on examining all the circumstances that it does not pay to breed horses in Fiji when a great horse-breeding country like Australia is near at hand and ready to supply any number of animals at a moderate price. On the other hand it ought to pay well to breed mules, which could be done very well by mating good imported jack asses with good country bred mares, and these animals are deemed to be the more suitable for the conditions of plantation work.

EGYPT. **Ministry of Agriculture, Veterinary Service, Annual Report for the Year 1918–1919.** [LITTLEWOOD (W. L.), Director]. 39 pp. 1920. Cairo: Govt. Press. Price: pt. 5.

This report is divided into three sections dealing respectively—(1) with contagious diseases, (2) the veterinary pathological laboratory, and (3) the school of veterinary medicine.

CONTAGIOUS DISEASES.

Cattle plague and double inoculation.—During the year there were 873 deaths from cattle plague reported in two Governates and 14 Provinces. This brings the total number of registered deaths reported in Egypt since the reappearance of the disease in June 1903 to 182,332. The death rate from natural infection amounted to 0·08 per cent., as against 0·43 per cent. in the preceding year. In addition, 654 cases were detected amongst cattle imported from the Soudan in the various quarantine pens and Cairo abattoir. During the preceding year 4,680 deaths were reported in the Interior and 527 cases were detected among cattle imported from the Sudan. 40,301 cattle were actively immunized in 1918–19 with 189 deaths, following upon the double inoculation. Of this number 4,361 were inoculated at the request of their owners upon payment.

On 24th August 1918 five bulls of the Domains Administration that had been immunized by this method six years and two months previously, were given 5 cc. each of virulent rinderpest blood. No reactions or departure from the normal in condition were subsequently noticed. Of these five bulls two had reacted and three had not reacted when inoculated in June, 1912.

On 27th October 1918, 10 bulls of this Administration that had been immunized by the double inoculation in June 1912, were given 5 cc. each of virulent blood; four had reacted and six had not reacted to the first inoculation. The bulls were then placed under careful observation for 15 days and during this time there were no reactions produced or any visible sign of illness.

On the same day a control Cyprus bull was inoculated with the same blood and it developed rinderpest. This experiment would appear to indicate that a very durable immunity existed in these cattle, which had lasted six years and four months, and then showed no sign of weakening.

The actual stock of anti-rinderpest serum amounted to 79,438·5 units of 50 cc. Egyptian and 57,472 units of 50 cc. Indian serum on 31st March, 1919. The Egyptian serum was found to have lost its protective power owing to age, as it had been stored since 1915. It was therefore condemned and destroyed.

Rabies.—Ninety-seven cases reported (86 dogs, 5 cats, 5 wolves, 2 donkeys), as compared with 117 in the previous year. The cases were reported in four Governates and 13 Provinces. 4,759 dogs in all were seized in Cairo and sent by the Police to the Dogs' Home, most of them being destroyed unclaimed. In addition the police destroyed during the year 3,767 dogs and 5,622 cats in Cairo and its suburbs; 3,162 dogs and cats were seized in Alexandria. In Cairo 165 dogs, 7 cats, 6 monkeys, 2 foxes, 1 mule, and 10 horses were placed under observation as they had bitten persons. In all cases of outbreaks of rabies and in cases of suspicion a certain number of dogs in the villages were destroyed in order to prevent the disease extending; hence in the Mudiriyas and Governates 42,508 dogs and cats were poisoned.

Glanders.—Sixty-one cases were detected in four Governates and four Provinces, as against 41 cases in the preceding year. 4,125 animals were tested with mallein in Egypt.

Epizootic lymphangitis.—Six cases reported, as against 18 in the previous year, in the Cairo and Alexandria Governates.

Anthrax.—Fourteen cases reported (1 donkey, 3 camels, 1 bull and 9 sheep).

Sheep pox.—823 cases reported, most of these being Sudanese sheep as against 296 in the previous year.

Foot-and-mouth disease.—No cases reported. In the previous year 181 cases were reported, all in Sudanese animals.

Haemorrhagic septicaemia.—Twenty-four cases in cattle, buffaloes, and sheep, against 98 cases in the previous year; these occurred in one Governate and six Provinces. This disease is very common in Egypt and the Director is of the opinion that the losses are much greater than those notified. Preventive serum was used in several outbreaks; 1,266 animals were injected with serum with satisfactory results. A large loss might be avoided if this disease was notified early.

Mange.—943 cases, mostly in imported Sudanese sheep. In connection with several S.P.C.A. in the Mudiriyas 1,608 camels were treated for mange. The necessary drugs were issued by the Service against payment.

Strangles.—Forty-one cases, against 91 cases in the previous year, in one Governate and five Provinces.

Spirochaetosis in Fowls.—One case only reported in a hen, against five in the previous year.

Trypanosomiasis.—One case only reported in an imported Sudanese bull, against 149 in the previous year.

Filariasis.—No cases reported; in the previous year 77 cases were reported.

Piroplasmosis in Egyptian Animals.—Eighty-seven cases detected (86 in cattle and 1 in a horse) in one Governate and 10 Provinces. Ten of these animals had been imported from Cyprus. Of these 47 cattle died or were slaughtered and 39 cattle and one horse recovered. In the previous year 105 cases were reported. The disease is very common in Egypt and much might be done to save the lives and usefulness of cattle if veterinary advice were sought for. Destruction of ticks infesting cattle by spraying with an arsenical preparation has during the last three years been carried out in order to prevent the disease. Owners of cattle now appreciate its usefulness and during the year, 3,325 cattle were sprayed against payment.

Piroplasmosis in Sudanese Animals.—Ninety-six cases reported (92 cattle and four sheep). These occurred in the Shellal and Cairo quarantine pens; all died or were slaughtered. In the previous year 38 cases were reported.

Tuberculosis.—3,524 cases reported, detected almost entirely in the Cairo and Alexandria abattoirs. This would indicate that 5·21 per cent. of the number slaughtered were affected with tuberculosis, as diagnosed by post-mortem examination. 2,210 cattle belonging to the Domains Administration were tested with tuberculin and of this number 963 gave positive results (43·5 per cent). One must therefore conclude that a large number of Egyptian animals are affected with tuberculosis.

Tetanus.—Eleven cases reported against 21 cases in the previous year, distributed in one Governate and six Provinces.

Ovine Caseous Lymphadenitis.—No cases detected. Three cases reported in the previous year.

Coccidiosis.—Fifty-eight cases detected (almost entirely in imported Sudanese animals) against 27 in the previous year.

Contagious Bovine Pleuro-pneumonia.—Thirty-six cases detected, all animals imported from the Sudan. In the previous year 211 cases in were detected.

Stiff Sickness.—During the year five cases only were reported, against one case in the previous year. The disease has become prevalent, but as it assumed a mild form very little notice was taken of it and cases were not reported.

Bursati.—Four cases reported (two mules and two donkeys); no cases reported in the previous year.

Cow Pox.—No cases; seven reported in the previous year.

Camel Pox.—One case detected, against 38 cases in the previous year.

Fowl Diphtheria.—One outbreak reported; 25 cases reported in the previous year.

Fowl Plague.—130 cases reported, against 72 cases in the previous year.

Fowl Cholera.—Four cases reported; none reported in previous year.

Actinomycosis.—One case only detected; against 26 cases in the previous year.

Malta Fever.—Eight cases detected in the Canal Governate against 50 cases in the same Governate in the previous year.

Swine Plague.—Nine cases reported. No cases reported in previous year.

Sudan Trade.—35,310 cattle and 204,627 sheep and goats were imported from the Sudan during the year, an increase of 6,282 cattle and 62,494 sheep and goats. Most of these animals passed through the Shellal quarantine station and figures are given concerning the number of animals and hides that passed through this station. Two bales of skins were imported from the Soudan via Suez for transhipment to foreign countries during the year, against 61 bales during the previous year.

Besides animals imported from the Sudan 180 cattle and buffaloes, 44 mules and donkeys, 5,984 sheep and goats, 822 pigs, and 21 camels were imported from other sources. The total number of imports during the year was 246,988, against 184,418 in the previous year.

Statistics are given regarding the isolation hospital for contagious diseases of animals, Abbasiya. The total number treated was 290 (mange being the chief disease observed, 230 cases), others consisting of glanders, epizootic lymphangitis, rabies, lousiness, and eczema.

The animal population of Egypt is now as follows: horses, 30,390; mules, 14,929; donkeys, 583,304; camels, 103,631; pigs, 18,929; sheep, 854,380; goats, 230,617.

718,920 animals were slaughtered in the public abattoirs, against 683,724 in the previous year. No frozen meat was imported by British firms as all Australian frozen meat was purchased by the British Government as in the previous year.

The number of veterinary legal cases showed a marked decrease.

Veterinary Pathological Laboratory [MASON (F. Eugene), Sub-Director and Pathologist in Charge.]

A large number of interesting specimens were examined at the laboratory both from the Egyptian veterinary service and from Army sources. An investigation into a serious mortality in equines proved the condition to be "enzootic equine paraplegia." A vaccine was prepared which, it is stated, gave satisfactory results. Experiments were conducted in an endeavour to find a satisfactory material of local origin for the treatment of mange in camels with a view to rendering the country in this particular respect independent of imported sulphur and oil. "Entirely successful results were obtained with colocynth tar." [For investigations into the properties of this substance in the treatment of camel mange *see* this *Bulletin*, 1919, June, Vol. 7, No. 2, p. 64 (SERGENT and LHÉRITIER); 1920, June, Vol. 8. No. 2, p. 138 (MUSSO), experiments at the Pasteur Institute, Algeria; and 1920, Dec., Vol. 8, No. 4, p. 308 (DONATIEN), Algeria.—ED.].

Investigations, which have not yet been completed, were conducted on rinderpest with very promising results. The high mortality in imported Cyprus goats was successfully investigated. Experiments were made upon the curative treatment of epizootic lymphangitis and successful results are claimed to have been obtained with novarsenobenzol provided the subjects were not advanced in age.

Investigations into the cause of high mortality in imported Sudanese sheep at Shellal, Cairo, and Qantara proved the disease to be coccidiosis.

School of Veterinary Medicine [RABAGLIATA (D. S.), Director]. Some remarks are written by Rabagliata on this school, in which there were 29 students on the books on 1st April. Four students obtained their diplomas in February, 1919. Considerable progress has been made with the plans of the new school at Giza and it was anticipated that the October session would open with the school installed in the commodious temporary premises lent by the Director of the School of Agriculture at Giza. With the return of the members of the staff who had been on active service and under new and better conditions it was anticipated that a new and successful era in veterinary teaching would be commenced in Egypt.

The report concludes with a number of tables giving a census of the animal population and slaughterhouse statistics.

NYASALAND PROTECTORATE. **Annual Report, Department of Agriculture for the Year ended March 31, 1920. Report Veterinary Division.** [GRIFFITHS (J. A.), Senior Veterinary Officer.] pp. 8–10 f'cap. 1920. Zomba: Govt. Ptr.

Rinderpest. The present situation is considered to be quite satisfactory. The operations of the Rinderpest Commission resulted in the formation of an " immune belt " in Tanganyika Territory between Lakes Nyasa and Tanganyika wherein all the cattle were immunized during 1917 and 1918. To the south of this there is a belt of country between the Lakes which is clear of all cattle. In Nyasaland, to the south of the cattle-free belt, there is a controlled area in which the cattle are registered, births and deaths are recorded, and movements of cattle are only allowed under permits issued by the veterinary staff in this area. Reports from Tanganyika Territory do not indicate that there is any rinderpest in the districts immediately to the north of the immune belt.

No outbreak of East Coast Fever has occurred outside the areas in which it is enzootic. It has not been possible to define the full extent of these areas and to carry out the recommendations for eradicating the disease owing to the shortage of veterinary staff.

In areas settled by Europeans there has been very little trouble from other tick-borne diseases except where dipping has been neglected. More dipping tanks are being built every year so that very soon it will be possible for most cattle owners to have a dipping tank available within a reasonable distance.

A few cases of demodectic mange occurred among cattle in the Blantyre District and all the affected animals were slaughtered.

Outbreaks of trypanosomiasis have occurred among cattle in various parts of the Shire Highlands; the disease was also very prevalent on the Namiwawa Stream to the south of Zomba, and cases were diagnosed outside Blantyre and at Mikalongwe, Mlanje, Malosa, and Kota-Kota. The sick animals at the last two places had been previously brought through tsetse belts, but in the other outbreaks there was no such history. In the Government Farm at Namiwawa the disease has occurred sporadically among work oxen for several years, in spite of the fact that animals found on microscopic examination of the blood to be infected are eliminated by slaughter. Several animals that were born on the farm became infected during the year, and as there are no tsetse on or near the farm or grazing areas the disease must have been transmitted by blood-sucking flies other than tsetse. Drug treatment was found to be of value in all cases where the animal had not reached the advanced stages of the disease. Treatment prolonged life and improved the general condition to such an extent that when combined with good feeding the animals could be slaughtered for food, while in about 60 per cent. of the favourable cases the animals were able to resume work. In advanced cases, where the animal had become weak or emaciated it either could not withstand treatment or derived no benefit from it.

A fairly considerable number of deaths occurred among cattle with gastro-enteritis as the most prominent characteristic. This condition was attributed to various causes, viz. :—

1. Arsenical poisoning, due to the animals swallowing dipping solutions. Very few cases that showed signs of abdominal pain recovered.

2. Coccidiosis. This is now described for the first time in Nyasaland and it was found to be the cause of heavy losses at Mikalongwe, and several outbreaks in small herds in the Zomba and Blantyre districts.

3. Poisonous plants. A fairly common cause of gastro-enteritis towards the end of the dry season, and at the beginning of the rains. Various poisonous plants are incriminated, together with over-feeding on the fresh flush of young green grass after the first rains.

4. Parasites. Round worms in calves occasioned heavy losses throughout the Shire Highlands.

Losses occurred amongst cattle due to liver fluke invasion, especially when the infected animals had had to undergo long journeys or had their recuperative powers depressed by other causes. Infestation with this parasite was most commonly noted in the Ncheu District.

The most common diseases of sheep were :—

1. Distomiasis, due to infestation of the liver with *Fasciola gigantica* ; this caused losses among European-owned sheep in the Zomba District.

2. Tapeworms, which invested the bile ducts as well as the intestines. This condition was a very common cause of poverty in sheep throughout the Highlands.

3. Contagious pneumonia. Caused an outbreak with high mortality in a small flock on the Government Farm at Namiwawa.

4. Grass poisoning. Stated to have caused heavy losses on the Ndindi Marsh, Port Herald District; the animals were poisoned by feeding on fermenting vegetation and young green grasses as the water subsided after the floods.

Pseudo-rabies of the Dog. There appears to be a disease of dogs and cats in Nyasaland which clinically closely resembles true rabies in all its symptoms. It is apparently transmitted by the bite of an infected dog to a healthy dog or cat. In six cases which came under observation there was a history of the animal having been bitten by an apparently rabid stray native dog about a fortnight before any symptoms were seen. The first symptoms were uneasiness, apparent difficulty in swallowing, and in some cases dribbling of saliva from the corners of the mouth. There was a general hyper-sensitive condition, twitching of the muscles, and a loss of co-ordination of the limbs so that the animal walked in an aimless fashion. As the condition progressed, the animal, which apparently never slept, sometimes kept up at intervals a peculiar wailing cry, and in the later stages snapped at imaginary objects. In the observed cases death occurred in from two to seven days from the onset of symptoms. Paralysis of the muscles concerned in swallowing in some cases gave rise to the belief that the trouble was due to some foreign body in the mouth or throat. Post-mortem there was stated to be congestion of the cerebro-spinal vessels, and the stomach in every case contained various foreign bodies.

In Nyasaland there appears to be no case on record of any human being having contracted rabies from the bite of a dog, and the only case of a positive reaction to the biological test for rabies is one recorded by GARDEN (G.) in 1916. [Compare observations in West Africa, p 173 of this Bulletin, (TEPPAZ and BOUFFARD).]

During the year 18 breeding bulls and 164 breeding cows were imported, together with 252 head of slaughter stock and trek oxen, and 23 pigs, 10 dogs and 1 donkey. Some of these were imported from England.

The work of the Veterinary Department was confined to dealing with outbreaks of contagious disease in southern districts and there was no time available for undertaking special research work on the problems of local diseases. There is very urgent need for a research laboratory. With the development of the country, stock of all kinds has increased from 100 to 200 per cent. in market value, with the result that demands on the veterinary services are considerably increased. The diseases which require special investigation are stated to be coccidiosis, trypanosomiasis, plant poisons, various diseases caused by parasites, pseudo-rabies in the dog, and the pernicious anaemia of cattle which is a cause of losses in the Blantyre and Zomba districts.

GOLD COAST. **Report of the Veterinary Department for the Year 1919.** [BEAL (W. P. B.), Veterinary Officer.] 12 pp., f'cap, 1920, Gold Coast: Govt. Press, Accra.

General routine work was carried out as in previous years at Coomassie and on tours of inspection. No investigation or experimental work on animal diseases was undertaken during the year.

In this connection it is interesting to note that an important monograph entitled " Report on the Live Stock Industries of the Northern Territories of the Gold Coast Colony " has been published recently by BEAL [an extract will be found in this *Bulletin*, 1921, Vol. 9, No. 1, p. 36).

Some thousands of cattle are imported into the Gold Coast by land, the chief sources of supply being the French markets in Upper Senegal and Niger and neighbouring territories. The principal ports of entry into the Northern Territories are Bawku and Navarro, and a small number enter at Tumu. 29,539 cattle were registered at the first two centres and 3,634 at Tumu and other places on the frontier of the North-western Province. The number of cattle passing into and through this Province has decreased considerably, largely because the French authorities wish to conserve the supply of cattle for their abattoirs at Lydianne and Bamako. The cattle that enter at Bawku finally make their way to different parts of east and central Ashanti and to the Eastern Province of the Colony, while most of those registered at Navarro go to different parts of western and central Ashanti. No correct record of the cattle trade in Ashanti is known, but cattle trade in Coomassie is in a bad state, for the market is not a popular one with up-country importers, due to the long credit system and English currency notes, which are of little use in the French Soudan. The average price per head of cattle in this market was £10, but owing to a shortage of French currency notes towards the end of the year prices more than doubled. The number of imported cattle presented at Coomassie was 6,915, a decrease of 3,983 head from that imported in 1918. Of this number 15 head were stopped and died in detention, four from trypanosomiasis, three from rinderpest, and eight from pneumonia. The number of cattle passed for exportation by railway from Coomassie was 2,263 head, together with 1,170 sheep and 320 goats. The local trade in cattle hides was 13,780, a decrease of 20,861 on the year 1918. The great decrease in the trade of hides coincides with the great decrease in the number of cattle imported into Ashanti. Cases of mange were noted in dogs, sheep, and goats in Coomassie town and the affected animals were killed.

Details are added concerning the live stock farm at Coomassie, where a small herd of cattle is kept for breeding purposes. The information gathered on the tours of inspection has been alluded to largely in the report mentioned above.

Contagious diseases.—Anthrax is enzootic in the country and outbreaks and sporadic cases occur chiefly in the low-lying breeding areas. There is no doubt, it is stated, that many cattle and sheep contract the disease in a mild form and recover.

Contagious bovine-pleuro-pneumonia is also enzootic and several cases were encountered in the north-eastern Province of the Northern Territories.

Epizootic lymphangitis in horses appears to be widespread, and contagious foot rot of cattle and sheep is an important condition and has to be distinguished from foot-and-mouth disease.

From reports received it appears likely that infectious anaemia of horses is prevalent in the country. Cases of filarial infection were met with in horses and blood smears of cattle frequently showed unsheathed filaria embryos. An outbreak of fowl cholera was encountered. Blood smears prepared from slaughtered cattle frequently showed *Th. mutans.* No Koch's bodies have yet been discovered in these animals and no cases of *B. bigemina* infection were seen. Rinderpest was not observed on the tour of inspection, but cases were seen at Coomassie in imported cattle. Haemorrhagic septicaemia in cattle, spirochaetosis in fowls, and strangles in horses were seen. There were no facts of importance to add in connection with trypanosomiasis. Several new tsetse fly areas have been mapped out and a few specimens of *G. morsitans* and *G. tachinoides* were collected. *Haemonchus contortus* causes a very high rate of mortality in sheep. Some experiments were conducted on the production of good grazing grass.

Report of the Committee on the Staffing of the Veterinary Departments in the Colonies and Protectorates. 10 pp., f'cap., 1920. London : H.M. Stationery Office. Cmd. 922. Price 2*d.* net.

The Committee appointed by the Secretary of State for the Colonies to consider the staffing of the Veterinary Departments in the Colonies and Protectorates consisted of :—

Sir Herbert J. READ, K.C.M.G., C.B., Assistant Under-Secretary, Colonial Office (*Chairman*).

Sir John MCFADYEAN, M.B., B.Sc., M.R.C.V.S., LL.D., Principal of the Royal Veterinary College, London.

Sir Stewart STOCKMAN, M.R.C.V.S., Chief Veterinary Advisor to the Ministry of Agriculture.

The President of the Royal College of Veterinary Surgeons.

Professor O. Charnock BRADLEY, M.D., D.Sc., M.R.C.V.S., Principal of the Royal (Dick) Veterinary College, Edinburgh.

Professor J. Share JONES, D.V.Sc., M.Sc., F.R.C.V.S., Director of Veterinary Education and Professor of Veterinary Anatomy in the University of Liverpool.

Major R. D. FURSE, D.S.O., Assistant Private Secretary (Appointments), Colonial Office.

The terms of reference were :—

(*a*) To consider whether the Staffs of the Veterinary Departments in the various Colonies and Protectorates are adequate, and, if necessary to recommend increases of staff ;

(*b*) To consider whether the rates of salary offered to the Veterinary Staffs are adequate, and, if necessary, to suggest improvements ;

(*c*) To make recommendations for improving the arrangements for recruiting Veterinary Staffs for the Colonies and Protectorates.

With regard to the first and second terms of reference the Committee recommended a considerable increase in personnel as well as an appreciable improvement in the salaries to be offered to the veterinary staffs in several cases, viz. : East Africa (East Africa Protectorate, Uganda, Nyasaland), and West Africa (Gold Coast, Sierra Leone, Gambia), Cyprus, and Fiji. No revision was considered necessary in certain Colonies, viz. : Zanzibar, Straits Settlements, Federated Malay States, Mauritius, Trinidad, Bermuda and Barbados, and the Falkland Islands.

The situation in Nigeria, the Tanganyika Territory, and the Windward Islands with regard to veterinary matters is stated to be the subject of correspondence between the Secretary of State and the local Governments. The cases of Nigeria and the Windward Islands (with the exception of St. Lucia) were not considered further pending the issue of the correspondence. As regards the Tanganyika territory, proposals were awaited from the Administrator with reference to the establishment of a permanent Veterinary Department, but the Committee recommended that in the grading of the personnel and the provision of appropriate salaries the principle should be observed of securing as great a degree of uniformity as possible between this territory and the Protectorates of eastern Africa. In the case of Ceylon, British Guiana, Jamaica, and the Leeward Islands, the information available concerning the present situation, and further possibilities with respect of veterinary matters was not considered sufficiently detailed to enable the Committee to determine whether the existing veterinary staffs were adequate to carry on the work or whether they received suitable salaries.

Where increases in personnel and pay were recommended, particularly in the case of the East Africa Protectorate, the Committee considered that the veterinary staffs in these places were inadequate to cope with the work demanded of them. It was confidently anticipated that the additional expense involved by the adoption of the proposals would be amply recompensed by the results. The importance of the stock industry to East Africa, it is stated, has not hitherto been recognized and the Committee wish to associate themselves cordially with the views of Major-General Sir E. NORTHEY, who regards cattle rearing as the paramount industry of the Protectorate which he governs. The prosperity of the Protectorate is largely therefore bound up with the wellbeing of its animal population, and the Government ought to provide a Veterinary Department sufficiently strong to ensure the competent care and supervision of the country's live stock. In the process of general readjustment following on the war, and perhaps as the result of the land settlement scheme organized by the Government for ex-service men, the East Africa Protectorate will in all likelihood take rapid strides forward towards the future predicted for it as a settlers' country. Should this hope be realized, it will in all probability follow that the country's teeming herds will steadily multiply in number beyond the present total of 2,000,000 head which now grazes on the pastures from Kenya to Kapiti, on the Uasin Gishu plateau and the uplands round Londiani. It would be well, therefore, that the Veterinary Department, while organizing its resources for a more effective campaign against cattle disease, should at the same time make ready to face an expansion of work.

The same considerations are held to be applicable to the Tanganyika Territory and Uganda. A particular feature of the position of Uganda is that very many of the diseases which are rife amongst the live stock of East Africa originated in that Protectorate. It is thus of supreme importance to the whole of East Africa that the Veterinary Department of Uganda should be strong enough and sufficiently well equipped to cope with these scourges as soon as an outbreak is threatened and thus to check the evil at its source.

To improve the condition of the live stock in East Africa and to maintain it at a higher standard, to eradicate as far as possible the diseases now prevalent, and to guard against their recurrence, to stimulate and encourage the cattle rearing industry, and so to assist in advancing the prosperity of our East African dependencies are objects which call for the most earnest consideration. The only practical measure for improving the arrangements for recruiting veterinary staffs in present circumstances, is, in the Committee's opinion, to offer the improved rates of salary recommended. The shortage of qualified veterinary surgeons, which was already pronounced before the war, has become accentuated by the interruption which the war caused in the course of studies for the veterinary diploma. Until those students who have entered the veterinary colleges subsequently to their release from military duties have completed their studies, it is inevitable that the number of men from whom the veterinary staffs can be recruited will continue to be very limited. So long as these abnormal conditions prevail, the means adopted to recruit veterinary personnel must necessarily take the form of *ad hoc* measures devised to meet special local requirements or to combat particular emergencies. New posts should be filled by selection of suitable officers as soon as circumstances may permit.

In nearly all the Colonies and Protectorates which the Committee considered, the veterinary departments are at present branches of the agricultural departments, and it is recommended that in future veterinary and agricultural work should be regarded as distinct and that the veterinary interests be entrusted to separate veterinary departments. The Committee further dwells upon the grounds for recommending the increases of salary and also re-emphasizes the importance of continuity of service in veterinary departments. With a view to offering brighter prospects of promotion and advancement to the members of the small veterinary departments, it is recommended that, where possible, a system should be introduced whereby the staffs of neighbouring Colonies and Protectorates would be interchangeable. This would secure to all officers of those departments the prospect of rising to higher and more responsible positions, wherein not only would the remuneration be greater but the work also would be more scientifically valuable.

A further question was considered, viz.: that of the appointment of a Director of Veterinary Research and Administration for the coterminous territories of East Africa, Uganda and Tanganyika. The Committee was not unanimous on the practicability of combining in the hands of a single Director the responsibility both for administration and for research over so vast an area, but they agreed that results beneficial to all three territories would accrue from the institution of some form of supreme authority which should guide the direction of research into the most fruitful channels, and co-ordinate to their combined advantage the administrative work of neighbouring veterinary departments all engaged in the handling of common tasks and the solution of similar problems.

The report is signed by all the members of the Committee.

RECUEIL DE MÉDECINE VÉTÉRINAIRE. 1921. July 15. Vol. 97. No. 13. pp. 387–395. **Procès-verbaux sommaires de la Conférence internationale pour l'étude des épizooties, réunie à Paris du 24 au 28 mai 1921.** [A Summary of the Minutes of the International Conference for the Study of Epizootics held in Paris from the 24–28th May 1921.]

The decision to hold an International Conference for the study of epizootic diseases, to sit in Paris, was made on the initiative of the French Minister of Agriculture (M. RICARD) in October 1920. Forty-three States responded to the invitation, including Germany, United States of America, Argentina, Austria, Belgium, Bolivia, Brazil, Bulgaria, Chili, Denmark, Republic of Dominica, Equador, Spain, Finland, Great Britain, Ireland, Canada, South Africa, Australia, India, New Zealand, Greece, Haiti, Hungary, Italy, Japan, Luxemburg, Morocco, Monaco, Nicaragua, Norway, Paraguay, Holland, Peru, Poland, Portugal, Roumania, the Kingdom of the Serbs, Croats and Slovenes, Sweden, Switzerland, Czecho-Slovakia, Tunisia, and Venezuela.

The agenda was as follows:—

(I)

1. Examination of the sanitary situation, especially in so far as it concerns rinderpest, foot-and-mouth disease, and dourine.
2. Exchange of information concerning contagious diseases. Publication of Sanitary Bulletins.
3. Eventual creation of a "Permanent International Bureau of Epizootics."

(II)

Sanitary measures applicable in the countries of export for dealing with exported animals: Quarantine Stations for animals destined for exportation.

At the first sitting HUTYRA placed on the table his report to the International Veterinary Congress at Berne, the conclusions of which had been unanimously approved. Short notes were prepared by the French delegation relative to rinderpest, foot-and-mouth disease, and dourine to serve as a basis for discussion. These notes were read by LECLAINCHE. In the discussion upon rinderpest attention was paid particularly to the susceptibility of the pig to the virus and the rôle of animals of this species in the transmission of the disease.

The Conference also dealt with the virulence of fresh animal products, notably meat; the conclusions drawn by the French Delegation were remitted to a special Committee.

In the discussion upon the note relative to foot-and-mouth disease, attention was paid to the value of sanitary police measures and also to the conditions of animal traffic between affected countries. The discussion was summarized and the conclusions referred again to a Committee. In the discussion upon dourine the history of the disease in Italy in recent times and the efficacy of treatment in combating this disease were dwelt upon. The conclusions proposed by the French Delegation were remitted to a Committee.

Three Committees were appointed with instructions, respectively: (1) To examine the means of grouping together all information upon sanitary problems and to express its views upon the utility of creating an International Sanitary Bulletin; (2) To study measures relative to exportation having regard to living animals and animal products; (3) To report upon the eventual creation of a permanent international bureau for combating epizootics.

The resolutions passed by the Conference, after receiving the reports of the Committees on the various matters outlined above, were as follows:—

I.—RINDERPEST.

1. On account of the uncertainty of our knowledge upon the resistance of animals and the variations in susceptibility due to difference in species and breed, or to individual circumstances, the introduction of ruminants and of pigs from regions which are not certainly free from infection constitutes a source of danger which justifies the enactment of prohibitory measures.

2. The prosecution of experimental researches is indicated upon the modes of infection, the susceptibility of the various kinds of animals, the virulence of different animal products, the dangers which may result from the transportation of virus by means of animals which have recovered or are healthy in appearance, and in a general way upon all that touches upon the experimental study of rinderpest.

Further, as the result of a discussion upon some supplemental proposals raised by HUTYRA and considered by the Rinderpest Committee, the Conference recommended that the struggle against rinderpest should be based upon the following fundamental rules:—

(1) Telegraphic information to be conveyed immediately to neighbouring countries as soon as new centres of the disease appear in regions up to that time free from it.

(2) The principle to be adopted should be compulsory slaughter of affected animals and clinical suspects, and also, to the widest extent possible, animals that have been exposed to infection, although they may be healthy in appearance, with immediate and full compensation.

(3) The use of a product which is virulent, or capable of recovering its virulence, for purposes of immunization in countries that are free from the disease to be forbidden.

(4) The industrial production of sera and vaccines against rinderpest to be forbidden in countries free from the disease, exception being made in the case of scientific establishments which are State controlled.

II.—FOOT-AND-MOUTH DISEASE.

1. The active prosecution of researches on the study of foot-and-mouth disease is indicated, especially with a view to the achievement of scientific methods of treatment and practical means of immunizing animals exposed to infection.

2. Without interfering in any way with the independence of investigators, co-ordination among the various laboratories that are devoted to the study of foot-and-mouth disease is desirable, and the results obtained (whether they be only negative or partial) in the laboratory and in practice should be immediately published and collated.

III.—DOURINE.

1. A careful and prolonged supervision should be exercised in all countries with a view to the ultimate determination of existing centres of the disease. Researches concerning treatment, practical methods of diagnosis, and persistence of the virus in animals that have apparently recovered should be prosecuted and the results obtained should be published forthwith.

The following supplementary proposals brought forward by OSTERTAG were adopted :—

(1) In threatened areas the stallions should be registered and submitted to a monthly veterinary inspection.

(2) In these areas all mares and asses already covered or destined to be put to the stallion should be registered or submitted likewise to a monthly veterinary inspection.

IV.—SANITARY INFORMATION AND SANITARY BULLETIN.

1. Sanitary information to be forwarded by telegraph to all countries adhering to the Conference as soon as rinderpest appears in an area hitherto free from the disease, and upon the diagnosis of the first cases of foot-and-mouth disease in a country likewise free.

2. Periodical printed bulletins to be drawn up according to a uniform plan, compulsorily furnishing information upon the presence and spread of the following diseases: rinderpest, foot-and-mouth disease, contagious bovine pleuro-pneumonia, anthrax, sheep-pox, rabies, glanders, dourine, and swine fever.

3. This information to be given in detail in the case of each province or department invaded: (*a*) the number of parishes or farms still infected at the commencement of the period in question; (*b*) the number of parishes and farms infected during the period under consideration, and, if possible, the number, by species, of affected animals and animals exposed to infection.

4. These bulletins to be published on the 1st and 15th of each month, and to be despatched within a period of not more than 10 days after the dates of publication, so as to reach without delay the Governments and their interested administrations or services.

V.—MEASURES FOR DEALING WITH EXPORTATION. QUARANTINE STATIONS

Animals, together with dangerous animal products destined for exportation from one country to another, to be accompanied with a certificate of origin and of health, delivered under the responsibility of the exporting country by a State veterinarian or vouched for by the State.

The text of the certificate will be studied in each country and the different texts will be examined at a later Conference with a view to arriving at a formula which will be submitted for the approval of the delegates of adhering countries.

VI.—INTERNATIONAL BUREAU.

The Conference passed a resolution urging the need of creating an International Office, at Paris, for combating infectious diseases of animals. This Bureau will have essentially as its object :—

(*a*)·To gather together and acquaint Governments and their Sanitary Administrations with facts and documents of a general interest concerning the spread of epizootic diseases and the means employed for combating them.

(*b*) To stimulate and co-ordinate all kinds of researches and experiments bearing upon the pathology or prophylaxis of every infectious disease of animals, the execution of which calls for international collaboration.

(*c*) To study suggested projects of international agreements relative to the sanitary police of animals and to place at the disposal of Governments signatory to these agreements means of controlling their execution.

The Office to be placed under the authority of a Committee composed of technical delegates from the various States, and these delegates will hold meetings periodically and at least once a year. With the approval of the Governments adhering to the International Convention held at Rome on December 9th 1907, it will be attached to the International Office of Public Hygiene.

It is the desire of the Conference that the French Government should prepare a projected convention on the basis of the resolutions adopted, communicate its propositions to all countries represented at the Conference, and invite interested Governments to nominate plenipotentiaries empowered with the signature of the State with the shortest delay possible.

The Conference authorized MM. LUTHARIO, POTTEVIN and LECLAINCHE to place themselves at the disposal of the qualified French authorities in order to provide them with facilities for the establishment of this projected convention.

TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY BULLETIN.

VOL. 9.] NOVEMBER 30, 1921. [NO. 4.

DISEASES DUE TO PROTOZOAN PARASITES.*

LANFRANCHI (Alessandro) & SANI (Luigi). **L'intrapalpebro-reazione nella diagnosi del Morbo Coitale Maligno.** [Intrapalpebral Reaction in the Diagnosis of Dourine.]—*Bull. Soc. Path. Exot.* 1921. July 13. Vol. 14. No. 7. pp. 374–378.

In 1915 these authors, in a preliminary note, referred to the results obtained by the intrapalpebral method of testing horses affected with surra, and they claimed that the reaction not only enabled them to detect the presence of the disease, but also to differentiate it from nagana.

Recently, dourine has become a somewhat serious problem among breeding-horses in Italy, and in this paper experiments are described in which the efficacy of the intrapalpebral reaction in the diagnosis of this disease was tested. The authors utilized as antigen a preparation of trypanosomes obtained in the pure state, viz., *T. brucei* and the virus "Lanfranchi." These trypanosomes were separated from the blood corpuscles by adding to the blood a haemolytic serum. They were then emulsified in pure glycerine (in the proportion of one to three), or in glycerine and normal saline solution, or in distilled water. In the case of infected animals the reactions obtained were almost similar to those observable in the case of a positive reaction to mallein. Swelling of the eyelids became manifest from the 3rd or 4th hour onwards, and attained its maximum in from the 12th to the 18th hour. It then slowly diminished in size and remained appreciable up to the 36th hour. A slight temperature reaction was usually noticeable, together with more or less marked local symptoms, such as photophobia and lachrymation. Animals which were undergoing treatment exhibited a local swelling, which developed more rapidly and reached its maximum towards the 10th or 11th hour and disappeared in 20 to 24 hours. The temperature reaction was also less noticeable. In the case of healthy animals the local reaction was almost comparable to that seen in animals undergoing treatment, but the temperature reaction and the other symptoms could usually be observed.

It will doubtless be possible, the authors claim, by utilizing *T. equiperdum* as antigen to obtain results of a practical interest.

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* Mr. J. T. Edwards left for India without having the opportunity of seeing the final proofs of this number.—ED.

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Nattan-Larrier (L.). **Infections par** *Trypanosoma equiperdum* **chez la souris et chez le rat.** [*T. equiperdum* Infections in the Mouse and Rat.]—*Bull. Soc. Path. Exot.* 1921. July 13. Vol. 14. No. 7. pp. 433–442.

The dourine trypanosome, as was shown by the investigations of Rouget and of Schneider and Bouffard, is sometimes virulent for the mouse and rat, and sometimes quite harmless for these animals. The virulent types, however, rarely lose their activity, whereas the harmless ones may become virulent, and again this acquired property of virulence may be readily lost. It thus results that the virulence of *T. equiperdum* cannot be fixed as in the case of *T. brucei* and *T. evansi*. These properties in the dourine trypanosome were studied by Nattan-Larrier in a strain obtained from Mesnil's laboratory in 1912. A series of passage experiments performed on mice and rats during the course of the succeeding two years is described in this memoir.

Briefly, the results were that the virus, which was at first only feebly pathogenic for mice, became readily and rapidly exalted in virulence during the course of these transmission experiments, until finally it became markedly potent. Its virulence thenceforward appeared to remain fixed for a period extending over more than a year, when the experiments were discontinued. In both the mouse and the rat, remissions during the course of infection became observable only when the virus had attained moderate activity. These types of infection made a sudden appearance during the course of the transmission experiments and were manifested with varying frequency over a period which varied somewhat in duration ; these forms then disappeared, and later were reproduced again for no apparent reason.

As the virus assumed greater activity in the mouse it increased proportionately in virulence for the rat, and the same appeared to apply to the guinea-pig.

Infection with the trypanosome would appear to be capable of setting up subcutaneous swellings in the head region of the mouse, recalling somewhat those seen by Rouget in the rabbit. However, it would seem that more frequently veritable sharply circumscribed "plaques" were set up in the rat as characteristic lesions, thus presenting an analogy with the skin lesions seen by Rouget in infected dogs.

Pricolo (Antonio) & Ferraro (Giuseppe). **Identificazioni dei Trypanosomi della Colonia Eritrea.** [The Identity of the Trypanosomes in the Italian Colony of Eritrea.]—*Clinica Vet.* 1920. Feb. 29. Vol. 43. No. 4. pp. 111–123.

In this article the authors present a studious review of the trypanosome question in Northern Africa as the outcome of some controversial statements made by di Domizio with regard to the identity of the trypanosomes which they claimed to have observed in the domesticated animals of Eritrea. In Eritrea, the authors conclude, two species of trypanosomes may be encountered, viz., *T. evansi* in camels and equines, and *T. vivax* (*vivax-uniforme*) in cattle. In natural circumstances, *T. evansi* could not be found in cattle and *T. vivax-uniforme* could not be demonstrated in camels or equines.

However, it would seem that the camel is susceptible to infection with *T. vivax*, and in support of this statement the results of one experiment are given. A camel, known to be free from trypanosomes by direct examination of the blood and inoculation of its blood into rats and sheep, was inoculated subcutaneously with 100 cc. of blood from a trypanosome-affected ox. Fourteen days after the inoculation, the camel's blood on direct examination showed numerous trypanosomes, which were found to be not infective for the rat, but infective for a lamb. The infestation was ephemeral, for a few days later the trypanosomes disappeared from the blood and were not subsequently observable. The camel died later as the result of some other disease. This would appear to be the only record in the literature of infection of the camel with *T. vivax*.

MARTOGLIO appears to have claimed that the camel is not susceptible to *vivax* infection.

DI DOMIZIO (Giovanni). **Su due Tripanosomi del Bestiame nella Somalia Italiana.** [Two Trypanosomes of Cattle in Italian Somaliland.]—*Bull. Soc. Path. Exot.* 1921. July 13. Vol. 14. No. 7. pp. 423–433.

In his original studies upon the trypanosomiases of Italian Somaliland, MARTOGLIO (F.), 1911, described (1) an affection, known to the natives under the name *Salaf,* peculiar to the camel and identifiable with surra; (2) *Ghindi,* affecting all the domesticated animals in the colony; and (3) *Gobiat,* restricted to cattle, at least as a natural disease and attributable to two different causal organisms, which he named, respectively, *T. somalilense* and *T. cellii.* Subsequently, as the result of observations made upon the same question, CROVERI (P.), 1919, confirmed MARTOGLIO'S statement with regard to the nature of *Salaf* in camels and with regard to the existence of *Ghindi* in all the domesticated animals, but maintained that the causal organism of this particular affection was not a new species, but could be identified closely with "*T. dimorphon.*" This author, however, failed to obtain confirmation with regard to the existence of *Gobiat* as an etiologically distinct morbid entity. During a period extending over more than a year, Di Domizio had occasion to examine numerous cases of trypanosomiasis both in cattle and horses in Italian Somaliland, and in these very common affections he was at the outset struck with the very marked morphological differences exhibited by the trypanosomes in the circulating blood of cattle and of horses affected with the disease known to the natives as *Ghindi.* These differences are clearly described, and the pathogenic characters of the two trypanosomes were also examined. It would appear to be incontestably established thereby that the trypanosome which was so markedly pathogenic for cattle belonged to the so-called "*dimorphon-congolense*" type, whereas the dimorphic or rather polymorphic trypanosome found in equidae was of the "*brucei-pecaudi*" type.

[In discussing this question, Di Domizio appears to accept the views of BRUCE and his collaborators, which, moreover, have been confirmed by the researches of BLACKLOCK and YORKE and DELANOE, that the trypanosomes named *dimorphon, congolense,* and *pecorum* constitute a single species, to which the name *T. pecorum* was given by BRUCE himself, while *T. nanum* appears to be simply a variety. In French and Italian writings there appears to be a persistent and obstinate tendency to retain the name "*dimorphon*" for this particular trypanosome, following the lead apparently of MESNIL, who relegated this name, originally invented by DUTTON and TODD for the trypanosome seen by them in Gambian horse sickness, to the small monomorphic trypanosome, which he subsequently fixed as a definite species on account of its morphological characters, present in this affection. It would be well if this name "*dimorphon*" were now dropped, as it is misleading when applied to an organism characterized by its monomorphism. Moreover, there appears to be doubt as to the need for keeping alive the name "*pecaudi*."—J. T. E.]

The alleged new species of trypanosomes described by MARTOGLIO under the names *T. somalilense* and *T. cellii* would appear to be merely attributable to mixed infections produced by both the above organisms and probably also to a third species of the *cazalboui* [*vivax*] type.

[The observations recorded by the authors thus appear to lend more and more support to the simple classification of the African trypanosomes, originally established by BRUCE, whereby all would appear to appertain either to (1) the *T. brucei* type, (2) the *T. congolense* (*pecorum*) type, and (3) the *T. vivax* type.—J. T. E.]

SCHEIN (Henri). **Coccidiose des Ruminants dans le Sud-Annam.** [Coccidiosis in Ruminants in Southern Annam, French Indo-China.]—*Bull. Soc. Path. Exot.* 1921. July 13. Vol. 14. No. 7. pp. 380–382.

Goats in the neighbourhood of Nhatrang are very frequently infected with a coccidium, probably *Eimeria arloingi*, identical with the organism described by VELU, in Morocco. Although almost all goats are infected, deaths are only produced in young animals suffering from debility at the time of weaning or during the rainy season, or as the result of intercurrent disease. In the winter of 1920–21, the disease became more serious than usual, and was particularly marked in goats infected experimentally with rinderpest. The animals suffered from profuse diarrhoea, sometimes blood-tinged, anaemia and rapid wasting. Post-mortem lesions could only be found in several parts of the small intestine; the mucous membrane was congested, thickened, and sometimes showed ulcers. There were also seen small, caseous-like masses from about the size of a millet seed to a rice grain. Sections examined histologically at these points showed a rich invasion with coccidia (young merozoites particularly) and destruction of the epithelium. On rare occasions sporulating oocysts were found in the faeces. On keeping the faeces in a moist chamber for a few days the proportion of segmented parasites became greater. The sporulating oocysts were ovoid in shape, 16–23 μ long by 12·5–17 μ broad, and contained four sporozoites, but no residual body. Each sporoblast was ovoid and measured 10 by 5 μ. It contained two sickle-shaped sporozoites about 2·5 μ in maximum width. No residual body could be seen. A strange feature about this enzootic is that the Nhatrang goats are raised on the seashore in a very dry, sandy district, which *a priori* would not seem to be favourable for the spread of the disease. However, goats and even adult goats, brought down from the more humid, mountainous regions frequently contract on arrival severe coccidiosis, which often kills them, even in summer, when there is but little rain.

A certain degree of tolerance towards infection would thus appear to be set up in young animals exposed to the disease from their early days. There are very few sheep in the district, and none of these appear to show any signs of coccidiosis.

The author also observed the presence of a coccidium, quite indistinguishable in appearance from the above, in calves and young buffaloes, which reacted to a rinderpest inoculation and showed severe intestinal symptoms. Healthy animals did not show these organisms, but it is probable that they might be carriers. The coccidia from the goat appeared, however, to be somewhat larger, and sporulated more quickly than those of calves and young buffaloes. SCHULTZ (C. H.) (see this *Bulletin*, 1915, Vol. 3, No. 3, p. 101) has already drawn attention to the fact that acute coccidiosis may be set up in cattle following upon the injection of rinderpest blood. Schein therefore suggests that in districts in which coccidiosis is enzootic it would be wise to increase the dose of anti-serum in preventive inoculation against rinderpest. and also to attempt treatment of the coccidiosis simultaneouslv.

CURASSON (G.). **Coccidiose de la chèvre en A.O.F.** [Coccidiosis of the Goat in French West Africa.]—*Rec. Méd. Vet.* 1921. March 30. Vol. 97. No. 6. pp. 129–130.*

This disease was first studied by MAROTEL in 1905, and has since been observed by various authors. Within recent years, Curasson encountered it with comparative frequency in the Soudan and in Senegal. He states that the disease has a seasonal distribution, appearing shortly after the commencement of the rainy season and abating when the dry weather becomes established. Young animals in particular are affected, and always very severely. It is rare for a kid showing diarrhoea and wasting to survive longer than 15 days. As many as 26 deaths occurred among 31 kids which the author attempted to treat in 1919–20. Contrary, however, to the experience of VELU, in Morocco, Curasson noticed quite a number of adult animals sufficiently affected to cause marked softening of the faeces and distinct wasting. Two old animals that died were found, on post-mortem examination, to be badly infested.

The first symptoms of illness noticed in the young animal are dullness, a tendency to remain isolated from the rest and rapid wasting. Coincidently, diarrhoea is observed, which becomes more marked; the animal lies down frequently, and finally remains recumbent. Death usually occurs in 12–15 days. Nervous symptoms are often seen, commencing usually about the day before death takes place. They do not take the form of simple convulsions preceding the death of the animal, such as are described by VELU, but are a definite train of symptoms which can easily be seen by making the affected animal rise. It staggers, sways on both fore and hind limbs, hangs its head, and, on beginning to walk, describes an arc of a circle of varying diameter, after which it falls down. If made to rise again, it repeats the process. It pushes against a wall or other obstacle that it may encounter. Before he was aware of the existence of this disease, the author was inclined to attribute these symptoms to an intoxication, on account of their analogy with those set up by eating the so-called "death plant" of the Bambara tribe. Later, however, he succeeded in reproducing them in kids by experimental infection with coccidia, and thus they are no doubt caused by the disease itself.

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* Abstracted by Mr. T. J. Bosworth, B.Sc., D.V.S.M., M.R.C.V.S.

Treatment is apparently useless. Drugs that were tried without success were emetin, hordenin, intestinal antiseptics and galyl.

Affected animals should be slaughtered and measures taken to prevent infection of the healthy. Pastures known to be infected and all damp pastures are to be avoided. In Senegal it is especially necessary to prevent the animals drinking from the large pits dug by the natives to catch water during the rainy season, which rapidly become polluted with human and animal excreta, and are thus an abundant source of flukes, strongyles, coccidia, and probably many other harmful parasites.

CROVERI (Paolo). **La sarcosporidiosi bovina nella Somalia italiana Suoi rapporti colla deficienza di nutrizione, peste bovina e tripanosi.** [Bovine Sarcosporidiosis in Italian Somaliland. Its Relationship to Diet Deficiency, Rinderpest, and Trypanosomiasis.]—*Clinica Vet.* 1920. Feb. 15. Vol. 43. No. 3. pp. 65–92. With 4 plates comprising 10 figs.

In this article Croveri describes an interesting neuro-muscular condition of cattle in Somaliland somewhat reminiscent of the chronic forms which are stated to occur sometimes in the South African cattle disease known as "lamziekte." Moreover, as transpired in the course of investigations into the nature of that disease, particularly as the outcome of HEDINGER's histological researches, sarcosporidia, which are found in great numbers in the muscles of affected animals, are here again incriminated. The article is indeed of value inasmuch as a most useful résumé of the literature dealing with sarcosporidial infestation in animals is given. Otherwise it certainly cannot be said that the author has proved his case that these protozoan parasites are directly accountable for the condition. Particular attention is paid to the investigations of HEDINGER in connection with lamziekte, and McGOWAN in connexion with the Scottish disease of sheep known as scrapie; and, as is well known, it is now universally held that this author's contentions were unfounded.

The disease made its appearance among cattle belonging to the Serum Institute in 1914, but it was subsequently found that cases occurred among cattle in other parts of the colony. Cases first usually appeared towards the end of December, became more numerous towards February and March, and diminished in May at the approach of the first rains, when the pasture again began to grow luxuriantly. Cattle of all ages and both sexes were affected, and in particular the serum-producing animals of the Institute were attacked.

The mortality-rate was always very high (95 per cent). Recovered animals showed no immunity, but seemed to be even more susceptible to a fresh attack—ending fatally. The percentage of animals affected was particularly high when certain predisposing conditions, such as deficient diet, affected to an equal extent all animals in a herd. In the district of Lugh about 100 per cent. became affected. Among virus-producers at the Institute the proportion was about 30 per cent., while among serum-producers it was about 14 to 15 per cent. In the following year the fatalities on the other hand were very few, inasmuch as young animals had been well nourished.

The disease generally ran a chronic course, rarely subacute, and very rarely acute. In the chronic form the disease is insidious in its onset, and, as a rule, the first symptoms observed are those of some difficulty or impediment in movement. Attention is often first attracted by the animals lagging behind the others in a herd, and it is usually found that such animals have lost their vivacity for some time in spite of unimpaired appetites. Otherwise, when grazing or when placed in their stalls, it is difficult to single out the affected animals from the others. When the herd is grazing on sandy soil the animals are often found to be addicted to eating sand, but this phenomenon is not observable in all animals. When carefully examined it is found that the lameness is accompanied by a marked rigidity of the muscular masses during movement. Otherwise no noteworthy symptoms are observable—the temperature, pulse, and respiration are normal, as also are the appetite, rumination and defaecation. The visible mucous membranes are pale in colour. In a more advanced stage loss of condition gradually sets in, whilst the muscular stiffness becomes accentuated, and before long the emaciation becomes most marked and the animals are no longer capable of following the others in a herd.

After a variable length of time, generally 7 to 20 days, and when the loss of condition has become marked, the animal is no longer capable of supporting itself on its feet. In the morning, thus, it may be found lying down quietly, perhaps ruminating, without showing the least signs of pain. If violently disturbed it does not get up, but if forcibly raised on to its feet it goes down again and the time it is capable of standing on its feet becomes progressively shorter as the disease advances. Usually this incapacity to stand is due to weakness in the hindquarters, for if disturbed the animal makes an effort to get up with its fore legs, but the hind legs refuse to respond. Nevertheless, the temperature, pulse, respiration and appetite still usually remain normal, and in many cases also rumination and defaecation function perfectly. In other cases rumination becomes partially suspended, and the animal becomes affected with constipation, followed by diarrhoea; but these symptoms are not characteristic.

At a more advanced stage paralysis extends to the fore quarters, and the animal lies down motionless extended on its flanks. If some forage is placed within reach the animal will attempt to seize it, as it is still capable of moving its head and tongue. Soon, however, the muscles of mastication and deglutition become paralysed and the animal becomes quite incapable of feeding. Thenceforward the emaciation, which may hitherto have not been very evident, becomes very striking, and the animal enters into a cachectic state before it eventually succumbs.

In a large majority of cases, and especially in calves, there become apparent, at the time when paralysis of the forequarters sets in, or sometimes before this phase, symptoms of muscular excitability affecting especially the neck muscles. The animal then presents an appearance exactly resembling that of tetanic opisthotonus. The superior cervical muscles are violently contracted, so that the head is carried backwards, the pupils are dilated, and thus the animal presents the characteristic expression of an animal affected with tetanus, and if the neck is straightened out forcibly it soon reverts to its former position. These symptoms of muscular excitability are never absent in the subacute form, but they may be absent in the chronic form, and they are more frequent in the calf than in the adult ox.

The time from when symptoms of muscular stiffness are first manifested up to the time of death varies from 25 to 50 to 60 days in the chronic type, but subacute or very rarely an acute type may be seen, the principal differences noticeable being the more rapid progress of the symptoms. The period of observable muscular rigidity may be very short or may be altogether missed on account of its short duration. The first symptoms of the disease are, then, incapacity to remain standing, followed rapidly by signs of paralysis, affecting the hindquarters, forequarters, the muscles of deglutition and mastication, and phenomena of muscular excitability, which, in general, are never absent in this form. This type runs its course in from one to two weeks. In the very rarely occurring acute form symptoms are exhibited only for three or four days. The animal is generally found lying down, unable to get up, and a state of muscular excitability quickly sets in, whilst the temperature, pulse, and other organic functions remain normal. Death occurs on the third or fourth day, preceded by a fall in temperature.

The post-mortem lesions are very few and certainly not characteristic. There is very often oedema of the subcutaneous connective tissue, slight oedema of the lymphatic glands, the blood is anaemic and clots slowly, and there is often some straw-coloured exudate in the peritoneal cavity. There is usually more or less distinct congestion of the mucous membrane of the fourth stomach, and in the small intestines lesions are most frequently found, and these may vary in degree from the simple congestion up to ulceration of the mucous membrane, the gravity of the condition depending on the duration of the symptoms. When death occurs rapidly, the changes are often absent, whilst they are slight in subacute cases. The first part of the large intestine is usually in the same condition as the small intestine, but the last part of the colon and rectum are usually quite normal. The liver, spleen, kidneys, bladder and lungs show no noteworthy changes. In the heart, lesions are found affecting the endocardium in about 85 per cent. of cases, and these are in the form of petechiae, sometimes covered with deposit, especially in proximity to the valves. The myocardium is generally flabby. The pericardial sac usually contains a quantity of a clear, straw-coloured liquid, and in some cases it may be turbid, due to the presence of fibrinous flakes.

In nearly all cases there is a diffuse or circumscribed leptomeningitis. The brain matter shows no visible lesion. The nervous lesions are more marked in cases where symptoms of excitability have been displayed during life. Sometimes there is an increase in the amount of cerebro-spinal fluid. In the subacute form one finds only slight intestinal lesions, rarely cardiac lesions, and always meningitis; whilst in the acute form meningitis is the only lesion, and it is always found.

The author made a careful study of the blood. It contained no pathogenic trypanosomes, but in some cases non-pathogenic *T. theileri* was seen, and in almost all the animals *Theileria mutans* could be discovered. In all chronic cases there was a gradual diminution in the red and white corpuscles, which eventually dropped to about half the normal number.

Throughout the muscular system there were always discoverable extremely numerous sarcocysts of all dimensions. These were from 10 to 14μ long by 5 to 7μ broad. In the intestines no coccidia or other pathogenic protozoa were discoverable. Bacteria were isolated from some cases, especially those in which there were gross intestinal lesions, but the author was unable to reproduce the disease in healthy animals by inoculation of cultures, or by ingestion, or by administration per rectum.

Various kinds of intestinal worms were found, such as Trichocephalus, Oesophagostomum and Haemonchus, but these did not appear to be sufficiently numerous, or, indeed, of sufficient pathogenicity to be responsible for the disease. Nevertheless, experiments were made in an attempt to transmit the disease by ingestion of living worms or their ova or larvae in various stages of development, with constantly negative results.

Some attempts were made at treating the disease on the assumption that sarcosporidia were responsible for the condition, but that a deficient nutrition was a predisposing cause. It was found that when an animal had entered into the second period of the disease, that is to say, when marked symptoms of stiffness or paralysis had become evident, no change in the quantity or quality of the ration was capable of arresting the course of the disease. Attempts at treating symptoms with tonics, stimulants, or sedatives, etc., likewise proved fruitless. Prophylactic treatment, nevertheless, gave invariably good results. When the animals are first seen to lose condition gradually, they should, immediately on their return from pasture, be supplied with a plentiful and nutritious diet. Thus, when the animals used for serum production at the Serum Institute were given such a ration, cases of the disease immediately ceased, whilst numerous cases occurred in a herd of calves which were left purposely to look after themselves during the dry season ; in fact, none of them escaped the disease.

The author concludes that in the first place the disease is not attributable to an infectious or parasitic intestinal invasion, but to a defect in nutrition, inasmuch as (1) the disease is manifested only among serum producers, which are submitted to a considerable drain upon their system, and not among the animals of the breeding station, which are given a sufficient ration ; (2) the disease is manifested always during the dry season, during which there is a lack or deficiency of pasture ; (3) the epizootiology and symptomatology of the disease is against the hypothesis of infectious or parasitic origin ; (4) when the organization of the Institute enabled it to provide the serum producers with a supplementary ration, cases of the disease disappeared ; and (5) the condition was set up artificially in a group of calves supplied with an insufficient diet.

The author further maintains that a diet deficiency is not sufficient to account for the muscular and nervous phenomena. In all animals dead of the disease sarcosporidia were found in enormous numbers throughout the muscular system, and it is therefore suggested that all these symptoms are possibly due to the presence of these parasites. The author examined for sarcosporidia the muscles of the tongue, pharynx, oesophagus, shoulder, buttocks and thighs, heart, etc., and found sarcosporidia in 69 (85 per cent.). In these 69 animals parasites were found in the oesophagus, tongue and cardiac muscle only in 59, and these 59 animals were in good condition. Of the 10 animals which also showed the parasites in their striped muscle, four which showed rare parasites were in good condition, whilst four which showed rather few were in poor condition, and two, in which they were very numerous, were in extremely poor condition.

The author therefore concludes that in the majority of Somaliland cattle, probably 85 per cent., and possibly in all animals if a more careful examination were made, sarcosporidia are to be found in the muscular system. But generally these parasites are limited to the smooth muscles of the oesophagus and of the tongue and to the heart muscle. Their abundance in the muscle would appear to be closely related to the state of nutrition of the animal. The author therefore emits the view that when the animal is in good condition the parasites are not capable of traversing the barrier formed by the first part of the digestive tract, but when it is in low condition they invade the whole body. [This does not appear to be true. See VILJOEN, 1920, Vol. 8, p. 302, and WALKER, p. 301.] In sucking calves sarcosporidia were not seen, and it would appear that the infection is contracted at pasture. This would contra-indicate McGOWAN's hypothesis that the sarcosporidiosis may be transmitted hereditarily. In calves at pasture the percentage invaded is almost identical with that in larger animals. In healthy calves kept in good condition the parasites were found to be limited to the oesophageal and heart muscles, as in adults; but in calves affected with rinderpest the striped muscles were also found to have become invaded, and in one calf slaughtered on the seventh day of the disease, spores were found in the circulating blood. From observations on calves affected with rinderpest at the Institute, the author concluded that during the course of the rinderpest infection the sarcosporidia depart from the seats normally affected, that is to say, the oesophagus, heart, etc., and invade the whole muscle system. In a considerable percentage (40 per cent.) of animals recovered from the disease a generalized invasion of the muscular system by the parasites was set up, and this produced a fatal form of the disease described in this paper. The animals which become affected with sarcosporidiosis are usually those in which rinderpest has produced the most grave effects. Likewise the author believes that in animals recovering from trypanosomiasis, sarcosporidial infestation may supervene.

[The author's description of this condition is of much interest and has been given quite fully above, for it appears to resemble other conditions found in tropical and sub-tropical countries, particularly the lamziekte of cattle in South Africa, and certain sheep diseases, notably "renguera" in South America, characterized mainly or merely by the presence of marked neuro-muscular symptoms without noteworthy lesions. Lately, the pathology of the South African cattle disease appears to have been very fully worked out. It would appear to be due to the effects of a toxin absorbed from the alimentary tract, and this toxin is elaborated by certain species of anaerobes found in the soil of certain localities. It would seem that this organism is ingested by the animals licking putrefying carcases which are allowed to lie about on the veldt in such districts; the depraved appetite which causes the animals to lick such material would be induced by a deficiency in diet. The particular ingredient deficient in the food appeared to be phosphorus, and by supplying mineral matter, such as bone ash, containing this element, the craving could be made to disappear and likewise the lamziekte. (See this *Bulletin*, 1920, Vol. 8, p. 261.) It would be interesting to find out whether the same factors are responsible in the Somaliland condition. The symptomatology of the two affections certainly presents striking analogies.—J. T. E.]

CÉSARI (M.). **Un procédé commode de recherche des sarcosporidies dans les muscles.** [A Convenient Method of Searching for Sarcosporidia in Muscle.]—*Rec. Méd. Vét.* 1921. Feb. 28. Vol. 97. No. 4. pp. 100–102.*

The usual method of searching for sarcosporidia in muscle tissue consists in making a microscopic examination either of cut sections or of small fragments that have been crushed between two slides. Whilst carrying out some investigations on the manufacture of sausages, Césari discovered by microscopic examination that the fluid which exudes from salted flesh often contains falciform corpuscles that are characteristic of sarcosporidia. It appeared to him that here was a simple and very convenient method of detecting sarcosporidia, and one that would reveal their presence even where invasion was so slight that it might be overlooked under ordinary conditions unless a very large number of preparations were made. He has not had an opportunity of testing its efficacy in the case of muscle containing calcified parasites, but its failure under these conditions would not be of great importance since such lesions are easily visible to the naked eye.

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* Abstracted by Mr. T. J. Bosworth, B.Sc., D.V.S.M., M.R.C.V.S.

In carrying out the method it is sufficient to take a fairly large piece of muscle, sprinkle it all over with salt, and place it in a receptacle, preferably a funnel suspended over a flask. In a few minutes a reddish serosity exudes from the flesh and collects in the vessel. A drop of this fluid is taken and examined between slide and cover glass under a magnification of 800 diameters. The characteristic corpuscles are seen as elongated elements, slightly crescentic in shape, with rounded ends. They have granular contents and show refractile points. Their length is about three times the diameter of a red blood cell. The numbers seen in such a preparation are proportional to the invasion of the muscle. This method may also be adopted with advantage for the preparation of the specific poison of muscle sarcosporidia (sarcocystine). All that is necessary is to centrifuge the serous fluid, thus obtaining a deposit of red blood corpuscles and sarcosporidia. By haemolysing the red blood cells and again centrifuging, a nearly pure deposit of sarcosporidia may be obtained. It remains to be determined whether the sarcosporidia which appear in the fluid are elements which were lying free in the capillaries of the muscle or the interfibrillar spaces, or whether they were actually contained within the utricles themselves.

DISEASES DUE TO METAZOAN PARASITES.

Riley (William A.). **A Provisional Key to the Adult Nematode Parasites of Equines.**—*Cornell Veterinarian.* 1921. Jan. Vol. 11. No. 1. pp. 21–41. With 36 text figs.*

"In spite of the interest in the study of the parasites of the horse and other equines which has been aroused during recent years, there is no comprehensive key by which the student may determine even roughly the specimens which come to his attention.

"The average 'determination' is made by running through a list of parasites of the host and selecting the name of the species found in the given organ and most nearly agreeing with the body measurements of the specimen in hand. Or, at best, the specimen is compared with the illustrations in some available text book and, with a comfortable disregard of the numbers of unlisted species, is duly labelled.

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" It is in the hopes of affording some assistance to the isolated worker, who has not access to the extensive literature of the subject, that the following key to the nematode parasites of equines is offered. It is avowedly provisional and subject to corrections, but nevertheless it is thought that by its use the great majority of adult nematodes of these animals may be located. It must be recognized that it is purely an artificial key and textual proximity of species in nowise necessarily indicates relationship.

" Moreover, especial attention should be called to the forms of intestinal strongylids now included under *Cylicostomum* (=*Cylichnostomum*). Under this genus there have been described up to date 23 species of equine parasites (including two from the zebra). Of these, 16 indicated in the key by (*) have been reported from North America, but there is no question but that a number of our species are as yet undescribed. The genus demands thorough-going study. It seems very probable that the species now included in it represent two or more genera.

" The characters which must be used in classifying parasitic nematodes cannot be seen with the hand lens but demand the use of the compound microscope or high powers of the binocular, and especially treated specimens. Whenever possible the worms should be killed in hot 70 per cent. alcohol. If they are to be mounted as permanent objects, there should be added to the alcohol 3–5 per cent. of glycerine and the bottle left loosely stoppered or plugged with cotton until the alcohol has evaporated and the worms left in pure glycerine. They should then be mounted in glycerine jelly.

" For temporary study of alcoholic specimens or specimens preserved in alcohol-glycerine, they should be removed to the carbol-alcohol mixture (carbolic acid 1 part, and absolute alcohol 4 parts) in which they promptly clear and show beautifully the details of structure. Before returning such specimens to alcohol glycerine, the carbolic acid should be well washed out in 70 per cent. alcohol, else they blacken. Boulenger, 1920, recommends ' pure white creosote into which the worms may be transferred direct from alcohol without shrinkage.'

" The illustrations accompanying the text have in most cases been adapted from the original figures, care being taken to represent correctly the salient distinguishing characters. On account of the great rarity and inaccessibility of Looss's fundamental monograph on the strongyles of the horse, most of his figures dealing with species reported from North America have been utilized, excepting, as a rule, those which have already been made available by Ransom and Hadwen, 1918.

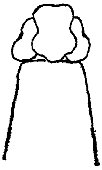
" The form of key used has been adopted for the purpose of conserving space. For those who are unaccustomed to this form, it may be explained that the number in brackets following each number is the alternative. If, for example, the specimen does not show the characters listed under ' 1 ' turn to ' 30 ' in the key.

" The writer wishes to express his indebtedness to Dr. C. P. Fitch and Dr. D. C. Beaver of the Veterinary Division of the University of Minnesota, for opportunities and generous aid in securing specimens.

" *Key to the Adult Nematode Parasites of Equines.*

" 1 (30) Mouth cavity not enlarged to form a buccal capsule. Males without a well-developed caudal bursa supported by a system of paired rays. (The genera *Trichostrongylus* and *Dictyocaulus* have feebly developed mouth cavities but males possess the bursa, hence see 30).

" 2 (5) Relatively thick worms. Mouth with three lips, of which the largest is dorsal, the other two ventral in position. ASCARIDAE.



1

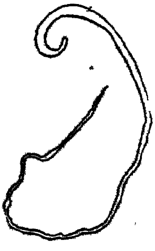
Ascaris equorum.
Dorsal view.

" 3 (4) Male with two spicules and numerous pre- and post-anal papillae. Female with caudal end conical. Ova globular or ellipsoid. Oesophagus with simple flask-shaped swelling. *Ascaris,* Linnaeus, 1758.

One species, *Ascaris equorum,* Goeze, 1782 (*A. megalocephala,* Cloquet, 1824), in small intestine of horse, ass and mule. Male 150–250 mm., female 180–370 mm.

" 4 (3) Male with one spicule and two pairs of pre-anal papillae. Female with caudal end elongated and subulate; eggs elongate, asymmetrical, with one side flattened. Oesophagus with a rounded bulb or a swelling at distal end. *Oxyuris,* Rudolphi, 1803.

Oxyuris equi (Schrank, 1788) (= *O. curvula,* Rudolphi, 1803) is found in the large intestine of Equidae. The female is 40–150 mm. long, arched at its anterior extremity and rapidly narrowed posteriorly into a tail varying greatly in length in different individuals. The males, which are very rarely collected, measure 9–12 mm. in length. Individuals with very long tails have been distinguished by some authors as *Oxyuris mastigodes* but most authorities regard them as of one species.

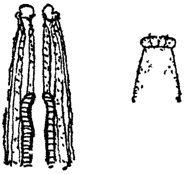


2

O. equi.

" 5 (2) Relatively more slender species.

" 6 (7) Minute females not exceeding 2·5 mm. in length; mouth provided with six lips; posterior end terminating in a very slender tail; pear-shaped oesophageal bulb; vulva near middle of body; no bursa; two spicules approximately equal.
Probstmayria vivipara
(Probstmayer, 1865), Ransom, 1907



3b 3a

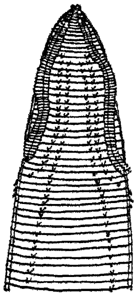
P. vivipara.
(*a*) Dorsal view of anterior end of body. After Ransom.
(*b*) Optical horizontal section through anterior end of body. After Ransom.

" 7 (6) Body long and filiform; oesophagus slender and without bulb. Males with caudal end coiled, and with two unequal spicules; one very long and one much shorter. Females with double ovary, vulva in most cases at anterior end of body. FILARIDAE.

" 8 (15) With striking and characteristic cuticular markings.

" 9 (10) Cuticular markings in the form of four thickened longitudinal cords at the anterior end. Males with lateral wings at the caudal end; females with simple ovary; oviparous.
Dispharagus, Dujardin, 1845.

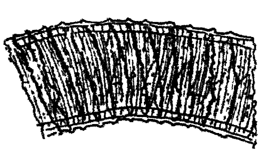
One species, *D. reticulatus*, has been found in tumors in the pharynx of the horse.



3¹

D. uncinatus.
After Schneider.

" 10 (9) Cuticular markings not in the form of four longitudinal cords.



4

Onchocerca cervicalis. Fragment of body, showing cuticular markings. After Railliet.

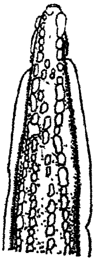
" 11 (14) Cuticle thick, cross striated and marked externally by spiroid thickenings. Male always with four pre-anal papillae; longer spicule terminating in a point, the shorter clavate, with a lateral retrograde hook. Female very long, vulva near head; viviparous. Inhabiting the connective tissue. *Onchocerca*, Diesing, 1841.

" 12 (13) Males up to 270 mm. long by 0·15 mm.; posterior extremity flattened and curved; six papillae on one side and seven on the other. Female 560 mm. in length by 0·25 mm. in diameter. Found especially in the suspensory ligament of the fetlock and the flexor tendons of the feet. *O. reticulata*, Diesing, 1841.

" 13 (12) Male 175–300 mm., female up to 400 mm., vulva situated about 400 μ from the mouth. In cervical ligament. *O. cervicalis*, Railliet and Henry, 1910.

" 14 (11) Anterior portion of the body covered with numerous cuticular tubercles, or shields, vulva of female in posterior end of body, near arms. *Gongylonema*, Molin, 1857.

Gongylonema scutatum (Mueller, 1869), Railliet, 1892, is found in the lining epithelium of the oesophagus of the horse, as well as of cattle and sheep.

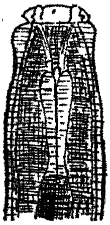


5
G. scutatum. Dorsal view. After Neuman.

" 15 (8) Without striking cuticular markings.

" 16 (21) Mouth followed by an infundibuliform pharynx which resembles a buccal capsule. Vulva of female more than a third of the length from the mouth. Tail of the male spirally coiled and with membranous wings. Relatively short and thick. *Habronema*, Diesing, 1861.

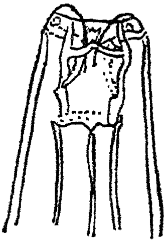
" 17 (18) Mouth with four thick chitinous lips which project in such a way as to present the appearance of a head constricted off from the remainder of the body. Males 7–10 mm. long; females 10–13 mm. In tumors in the stomach of the horse and ass. *H. megastoma* (Rudolphi, 1819).



6
H. megastoma. After Railliet.

" 18 (17) Without the constriction at the cephalic end. Larger species.

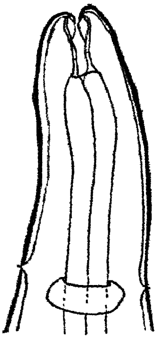
" 19 (20) Pharynx broad, its greatest diameter half the breadth of the body at the same level. A tridentate process projecting into the mouth from the dorsal wall of the anterior part of the pharynx and a similar one present on the ventral wall. Longer spicule of male 800 μ; the shorter one 350 μ. Vulva slightly over a third of the body length from the anterior end, rather large (diam. 30 μ) and approximately mid-ventral in position; vagina with a distal S-shaped curve. Males 9-16 mm. in length; females 15–25 mm. *Habronema microstoma* (Schneider, 1886).



7

H. microstoma.
Anterior end of adult.
After Ransom.

" 20 (19) Pharynx narrow, its greatest diameter less than one-fourth the breadth of the body at the same level; pharynx without tooth-like processes. Longer spicule of male about 2·5 mm., the shorter one 500 μ. Vulva about a third of the body from the anterior end, very small and displaced dorsad; vagina without the distal S-shaped curve. Males 8–14 mm., females 13–22 mm., thus averaging smaller than in the above species. *Habronema muscae* (Carter, 1861).



8

H. muscae.
Anterior end of adult.
After Ransom.

" 21 (16) Without infundibuliform pharynx. Vulva of female in anterior third of body, usually near the mouth.

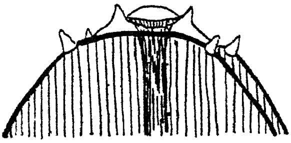
" 22 (23) Lips lacking; buccal capsule relatively small, oesophagus short. Males 8–12 mm. long, females 14–18 mm. long. Vulva posterior to end of oesophagus, parasitic in the eye. *Thelazia lacrymalis*, Gwilt, 1831.

" 23 (22) Lips present or absent, but not presenting the above characters; body long and filiform, of uniform diameter. Vulva usually opens near the mouth.

" 24 (25) Vulva lacking in gravid female, which is 50–80 cm. in length, and lives as a subcutaneous parasite. *Dracunculus medinensis*, Linnaeus, 1767.

" 25 (24) Vulva present in gravid female.

" 26 (27) Mouth armature of a projecting peribuccal ring considerably constricted laterally, less so dorsally and ventrally; a medium papilla both dorsally and ventrally. A little caudad of the mouth are two pairs of submedian spines. Males 6–8 cm. in length; females 9–12 cm.; in the peritoneal cavity, more rarely in the pleural sack, and other serosa, or in the eye.
Setaria equina (Abildgaard, 1789).

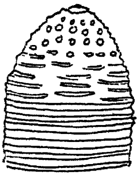


9

S. equina. Lateral view of anterior end. After Railliet.

" 27 (26) Not as above.

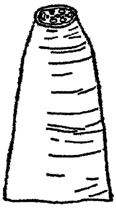
" 28 (29, 30) Anterior end with cuticular striae becoming irregular and forming elongate thickenings grading into elliptical and finally circular pattern; mouth naked and circular. Males 28 mm., females 40–56 mm. or even 70 mm., living together in the subcutaneous and intermuscular connective tissue.
Filaria haemorrhagica, Railliet, 1885.



10

F. haemorrhagica. Anterior end. Railliet after Condamine.

" 29 (28) Mouth without lips but with six nodular papillae; oesophagus very long without swelling; anus terminal in the female, vulva in the interior half of the body. Male with a terminal, oval bursa, which is not lobed; a single very long spicule. The largest of known parasitic nematodes; males 14–40 cm., females 20 cm. to 1 meter in length. In kidneys or body cavity.
Dioctophyme renale (Goeze, 1782).



11

D. renale. After Riley and Chandler.

" 30 (1) Body elongate, cylindrical, rarely filiform, well developed buccal cavity (except in *Trichostrongylus* and *Dictyocaulus*); mouth naked or with a chitinous armature; males generally with two equal or subequal spicules, and with well developed caudal bursa supported by a system of six rays. Vulva usually behind the middle of the body. STRONGYLIDAE.

" 31 (36) Mouth cavity very small, buccal capsule absent or feebly developed.

" 32 (33) Mouth provided with three little lips and with papillae. Caudal bursa with lateral lobes; spicules in the form of spatulae. Vulva situated in the posterior part of body. Males 3–8 mm., females 5 mm., in mucosa of stomach. *Trichostrongylus axei* (Cobbold, 1879).

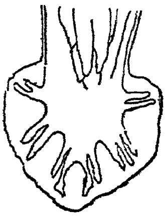
" 33 (32) Mouth circular and naked.

" 34 (35) Caudal bursa small, not lobed; middle rays simple, posterior tridentated; spicules small, acute. Tail of female short and sharp; vulva near middle of body. Eggs 85 by 35 μ. Males 40 mm., females 60–80 mm., found in the bronchi.

Dictyocaulus viviparus (Bloch, 1782).

" 35 (34) Caudal bursa short, faintly lobed, middle rays bifed, posterior thick, bilobate, and widely united at base. Tail of female short, slightly curving, terminating in a blunt point. Eggs 80 to 100 μ long by 50 to 60 μ wide. Males 28–36 mm., females 45–55 mm.

Dictyocaulus arnfieldi (Cobbold, 1884).



12

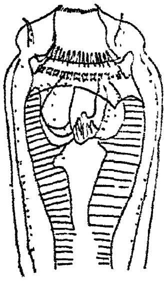
D. arnfieldi. Caudal bursa. Gedoelst, after Railliet.

" 36 (31) Mouth cavity enlarged to form a well developed buccal capsule, often armed with teeth in its interior.

STRONGYLINAE.

" 37 (40) Head separated from the body by a constriction. Buccal capsule consisting of an extra-oesophageal part and an intra-oesophageal portion formed by the chitinisation of the oesophageal funnel. Posterior to this dilation the oesophagus is very narrow, while immediately beyond the nerve ring it enlarges, thus giving the whole oesophagus the appearance of an Indian club, whose handle is the anterior end.

Gyalocephalus, Looss, 1900.

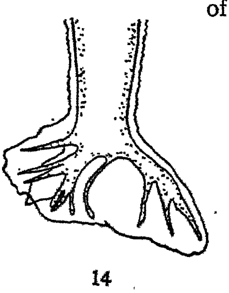


13

G. capitatus. Head, ventral view. After Yorke and Macfie.

" 38 (39) Genital cone of male extending as far as the free margin of the lateral lobes of the bursa.

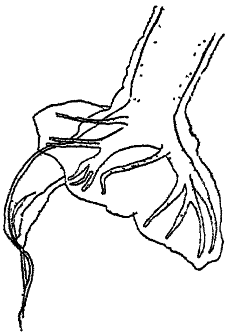
**Gyalocephalus capitatus*, Looss, 1900.



14

G. capitatus. Posterior extremity of male, lateral view. After Yorke and Macfie.

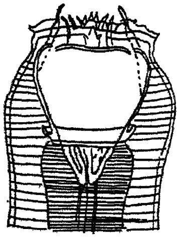
" 39 (38) Genital cone of male protruding far beyond the bursa, being about twice as long as in *capitatus*.
**Gyalocephalus equi*, Yorke & Macfie, 1918.



15
G. equi. Posterior extremity of male, lateral view. After Yorke and Macfie.

" 40 (37) Head not separated from the body by a pronounced constriction; oesophagus not shaped like an Indian club.

" 41 (42) Oesophageal funnel well developed and with three teeth; no teeth in or projecting into the buccal cavity.
Oesophagodontus, Railliet & Henry, 1902.

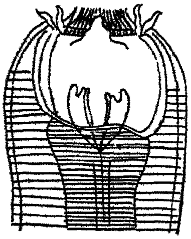


16
O. robustus.
After Boulenger.

* *O. robustus* (Giles, 1892) is found in the colon and caecum of the horse and ass. Body robust, tapering only slightly towards anterior end; males 15–16 mm., females 19–22 mm. in length; eggs from uterus 100–130 μ by 50–60 μ.

" 42 (41) Oesophageal lining not modified to form tooth-like structures.

" 43 (52) With three denticulate and often serrate teeth projecting into the buccal capsule from the oesophageal funnel. Borders of the caudal bursa denticulate.
Triodontophorus, Looss, 1902.



17
T. brevicauda.
After Boulenger.

" 44 (47) Teeth denticulate but not serrate. Dorsal lobe of bursa long; spicules slender.

" 45 (46) Male 13·5–14 mm., female 16–17 mm., mouth collar erect, elements of leaf crown 60. Vulva about 0·3 mm. from posterior end, immediately in front of anus.
***Triodontophorus brevicauda*, Boulenger, 1916.*

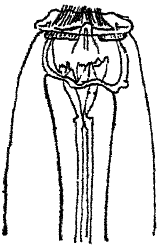
" 46 (45) Male 13 mm., female 14 mm., mouth collar depressed at margin; elements of leaf crown 44–49. Vulva about 0·7 mm. from posterior end.
Triodontophorus minor, Looss, 1902.

" 47 (44) Teeth denticulate and serrate. Dorsal lobe of bursa short; spicules comparatively thick and upwards of 4 mm. in length, except in *T. tenuicollis*, where they are slender and 1·25 mm. long.

" 48 (49) Vulva very close, ca. 0·5 mm. from posterior end. Dorsal lobe of bursa short and sharply marked off from lateral lobes. Dermal collar of genital cone completely surrounds cone. Spicules slender, 1·25 mm. long. Female 16–19·5 mm., male 13·5–19 mm.
**T. tenuicollis*, Boulenger, 1918.

" 49 (48) Vulva 1·5 to over 2 mm. from posterior end. Dermal collar of genital cone covers anterior surface. Spicules thick, 3·5–4 mm. long.

" 50 (51) Male 18 mm., female 25 mm., mouth collar slightly depressed at margin; elements of leaf crown 52–55. Vulva more than 2 mm. from posterior end. Spicules 4 mm. long.
**T. serratus*, Looss, 1902.



18
T. serratus.
Ransom and Hadwen, after Looss (modified).

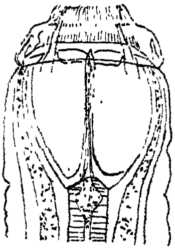
" 51 (50) Males 14·5–15·5 mm., females 16·5–18·7 mm., mouth collar circular in outline; elements of leaf crown 48. Vulva 1·45–1·7 mm. from posterior end. Spicules 3·5 mm. long. **T. intermedius*, Sweet, 1909.

" 52 (43) Teeth present or absent but not of the type above described.

" 53 (60) Buccal capsule very large, hemispherical or oval, with its dorsal wall strengthened by a longitudinal gutter which bifurcates at the base. No cervical papillae present. *Strongylus*, Mueller, 1784.

" 54 (55) No teeth at base of buccal capsule; oesophagus enlarged, club-shaped posteriorly. Male 23–26 mm., female 33–36 mm.

**Strongylus edentatus*, Looss, 1900.



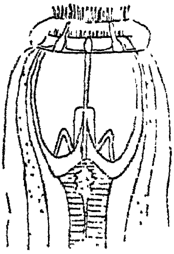
19

S. edentatus. Dorsal aspect. After Looss.

" 55 (54) Teeth present at base of buccal capsule.

" 56 (57) Four teeth, the dorsal high and slender, closely apposed with only basal ends diverging; the other two triangular in optical section. Oesophagus only slightly swollen. Male 35 mm., female 45–47 mm.

**Strongylus equinus*, Mueller, 1784.



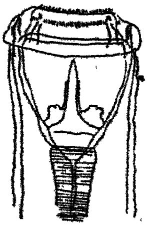
20

S. equinus. Head of male, dorsal view. After Looss.

" 57 (56) Apparently two rounded teeth at base of capsule (in reality lobes of a single tooth).

" 58 (59) Dorsal gutter not reaching anterior margin of mouth capsule; lobes of tooth broad as high in dorsal view, their margins cusped. Males 18–32 mm., females 30–42 mm.

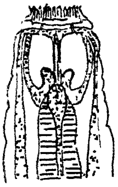
Strongylus asini, Boulenger, 1920.



21

S. asini. After Boulenger.

" 59 (58) Dorsal gutter reaching anterior margin of mouth capsule, lobes of tooth higher than broad in dorsal view, margins smooth, rounded. Males 14–16 mm., females 23–24 mm.
Strongylus vulgaris (Looss, 1900).



22
S. vulgaris.
After Looss.

" 60 (53) Buccal capsule smaller, more cylindrical; longitudinal gutter present or absent. A pair of cervical papillae just posterior to the nerve ring, near base of oesophagus.
Cylicostomum, Railliet & Henry, 1902.

" 61 (79) Caudal end of female bent dorsad. Head capsule without dorsal longitudinal gutter (except in *C. nassatum* and its variety *parvum*).*

" 62 (63) Dorsal gutter of oesophagus projects well into the head capsule. Walls of head capsule straight and slender, with a well marked hoop-like thickening posteriorly; ratio of breadth of anterior opening to depth 2·7 : 1, external leaf crown of 20 usually projecting elements. Tail bent only slightly dorsally. Males 10 mm., females 14 mm. in length.
**Cylicostomum nassatum* (Looss, 1900).
Males 7 mm., females 8·8
* variety *parvum*, Yorke & Macfie, 1918.

" 63 (62) Dorsal gutter not projecting into the head capsule.

" 64 Caudal end of female abruptly narrowed and bent dorsad at a greater or less angle.

* The dorsal bend of the tail in the females of *C. nassatum* and *C. nassatum parvum* is so slight that these forms may also be keyed under the alternative heading.

" 65 (72) Buccal capsule with walls thicker in the middle.

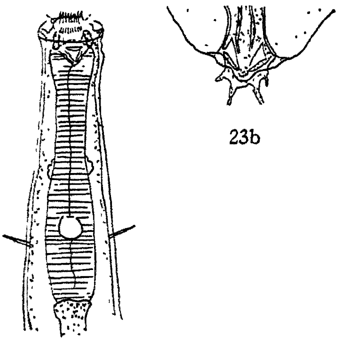
" 66 (69) Tail of female bent dorsad at an obtuse angle to body. Dorsal lobe of bursa of male elongate.

" 67 (68) Spicules very long and hair-like, genital cone enormously developed. Buccal capsule broad, ratio of breadth to depth 5 to 2. Males 12 mm. long, females 14 mm.
Cylicostomum mattami (Leiper, 1913).

" 68 (67) Spicules and genital cone not strikingly long. Buccal capsule relatively narrower; external leaf crown of 29 short, pointed, scarcely projecting elements. Males 10 mm., females 12 mm.
Cylicostomum alveatum (Looss, 1900).

" 69 (66) Tail of female directed dorsad at right angle to body. Dorsal lobe of bursa of male short and broad, almost hemispherical.

" 70 (71) Body small and rather delicate, male 5·2–6 mm., female 6–6·7 mm., with maximum breadth 0·3 mm. Dermal collar surrounding the genital cone; appendages of genital cone characteristic thin delicate plates, each provided with two very slender finger-like processes. **Cylicostomum goldi* (Boulenger, 1917).

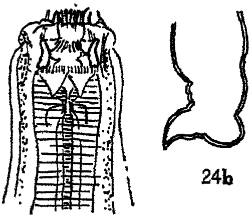


23b

23a

C goldi. (*a*) Anterior end; (*b*) ventral view of genital cone of male. After Boulenger.

" 71 (70) More robust species, male 7–8 mm., female 9 mm., with maximum thickness 350 μ. Caudal end of female with ventral prominences large and projecting. Appendages of genital cone of male not as above. **Cylicostomum catinatum* (Looss, 1900).



24b

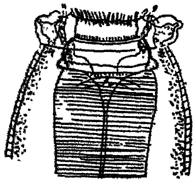
24a

C. catinatum. (*a*) Anterior end; (*b*) Ventral view of genital cone of male. After Boulenger.

" 72 (65) Buccal capsule with walls with a ring-like thickening at the base.

" 73 (76) Tail of female bent dorsad at an obtuse angle.

" 74 (75) Dorsal lobe of bursa of male broad; dermal collar of genital cone well developed; its appendages broad and fused mesally, each bearing a little papilla-like process. External leaf crown of about 36 large pointed leaves. Males 11–12 mm., females 13·5–15 mm. **Cylicostomum insigne* (Boulenger, 1917).



25

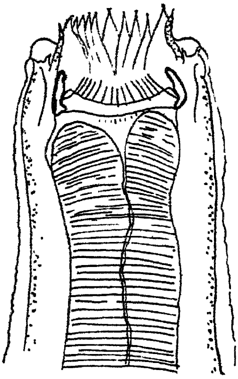
C. insigne. After Boulenger.

" 75 (74) Dorsal lobe of bursa narrow. External leaf crown of 26 rather flat elements. Males 11 mm., females 13–14 mm. **Cylicostomum radiatum* (Looss, 1900).

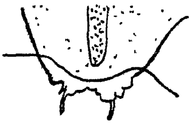
" 76 (73) Tail of female bent dorsad at right angles. Dorsal lobe of bursa short and broad.

" 77 (78) Walls of buccal capsule wedge-shaped, slender anteriorly, stout posteriorly, inner surface deeply notched ; ratio of breadth of capsule to depth 3·25 : 1. Ratio of posterior ray of bursa to body length of male 1 : 19·5 ; genital appendages slight elevations with three conical processes, of which the inner is the largest and has long delicate finger-like processes. Average distance between anus and vulva, 104 μ. Average length of males 8·6 mm., females 9·5 mm.

**Cylicostomum pateratum*, Yorke & Macfie, 1919.



26a

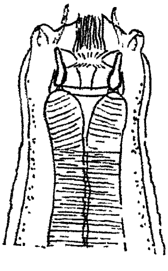


26b

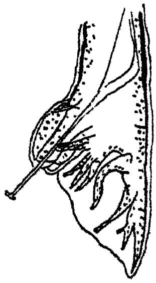
C. pateratum. (*a*) Anterior extremity, ventral view ; (*b*) Genital appendages, ventral view. After Yorke and Macfie.

" 78 (77) Walls of buccal capsule slightly kneed ; ratio of breadth to depth 1·5 : 1. Ratio of length of posterior ray of bursa to total length of male 1 : 22·4 ; genital appendages slight elevations, with two conical processes. Average distance between anus and vulva 61 μ. Average length males 5·8 mm., females 6·7 mm.

**Cylicostomum pseudocatinatum*, Yorke & Macfie, 1919.



27



28

C. pseudo-catinatum.

Anterior extremity, ventral view.

Posterior extremity of male, lateral view. After Yorke and Macfie.

" 79 (61) Caudal end of female practically straight, or slightly reflexed.

" 80 (92) Dorsal gutter not present in buccal capsule.

" 81 (84) Walls of buccal capsule kneed, or constricted at middle ; dorsal gutter represented by a blunt tubercle at floor of mouth capsule. Dorsal lobe of bursa long to very long.

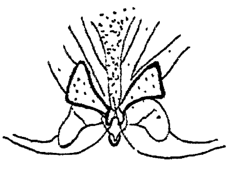
" 82 (83) Walls of buccal capsule thick, kneed. Dorsal lobe of bursa strikingly elongate and narrow, sides parallel. Ventral prominences at caudal end of female slight. Males 7–8 mm., females 9–10 mm.

**Cylicostomum coronatum* (Looss, 1900).

“ 83 (82) Walls of buccal capsule constricted in the middle, dorsal gutter represented by a blunt tubercle at floor of mouth capsule. Dorsal lobe of bursa moderately long. Tail of female short. Males 9 mm., females 10–12 mm.
Cylicostomum tetracanthum (Mehlis, 1803).

“ 84 (81) Walls of buccal capsule thick or with a ring-like thickening at the base or near the middle.

“ 85 (86 & 91) Walls of buccal capsule short, thick throughout. Dorsal lobe of bursa short; appendages of genital cone without projecting points; pear-shaped, their thinner extremities diverging laterally. Ventral prominences at caudal end of female project only slightly. Males 7–8 mm., females 9–9·5 mm.
**Cylicostomum labratum* (Looss, 1900).



29

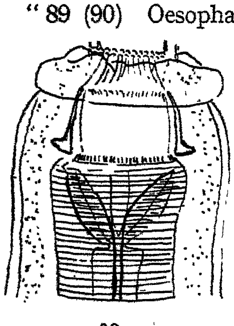
C. labratum. Genital cone, ventral. After Looss.

“ 86 (85 & 91) Ring-like thickening at base of buccal walls.

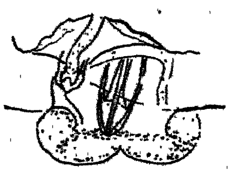
“ 87 (88) Buccal capsule very short, with ring-like thickening at the base. Dorsal lobe of bursa very short and broad. Tail of female very short, knob-like. Largest described species of the genus, males measuring 16–17 mm., females 26 mm.
Cylicostomum auriculatum (Looss, 1900).

“ 88 (87) Buccal capsule large and deep, with ring-like thickening at the base. Dorsal lobe of bursa long, smaller forms.

“ 89 (90) Oesophagus elongated, attaining 1·4 mm. in large females; external leaf crown of about 36 elements, whose rounded apices are usually curved outward. Dorsal lobe of bursa somewhat narrow and elongated; appendages of the genital cone strongly granular, completely opaque, allantoid, the rounded extremities bent inwards; no posterior point. Extremity of female gradually tapering to the anus, then suddenly narrowing into the short, stout tail. Males 13 mm., females 17 mm.
**Cylicostomum elongatum*, Looss, 1900.



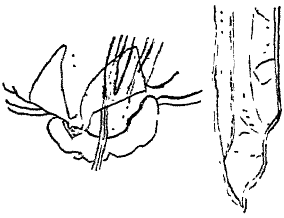
30a



30b

C. elongatum. (*a*) Anterior end; (*b*) Genital cone. After Looss.

"90 (89) Oesophagus shorter, 0·9 mm. in female; external leaf crown of 26 rather flat elements converging horizontally towards the axis. Dorsal lobe of bursa much narrower and elongate, appendages of the genital cone not strongly granular; more elongate and with a short blunt point on the posterior surface. Extremity of female more abruptly tapering to the anus. Males 11 mm., females 13–14 mm.
**Cylicostomum radiatum* (Looss, 1900).


31a 31b

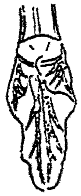
C. radiatum. (*a*) Genital cone of male; (*b*) Posterior extremity of female. After Looss.

"91 (85 & 86) Wall of buccal capsule thickest near the middle, thinning towards each end. Dorsal lobe of bursa moderate; genital cone relatively enormous (310–400 μ); dermal collar greatly developed on its ventral face, and pre-bursal papillae very elongate; appendages of cone long, narrow and cirrus shaped. Males 6–7·2 mm. females 6–8 mm.
Cylicostomum euproctus, Boulenger, 1917.

"92 (80) Dorsal gutter present, though sometimes short and inconspicuous.

"93 (96) Dorsal gutter long and well developed.

"94 (95) Species of moderate size. Dorsal lobe of bursa strikingly elongate with sides parallel. Tail of female slender and spine-like. Males 6–6·5 mm., females 8 mm.
**Cylicostomum calicatum*, Looss, 1900.


32

C. calicatum. Caudal bursa. After Looss.

"95 (94) Species small. Dorsal lobe of bursa short, less than a semicircle; ratio of posterior ray to total length of body 1 : 26. Males average 4·3 mm., females 4·9 mm.
Cylicostomum minutum, Yorke & Macfie, 1918.

"96 (93) Dorsal gutter short or very short.

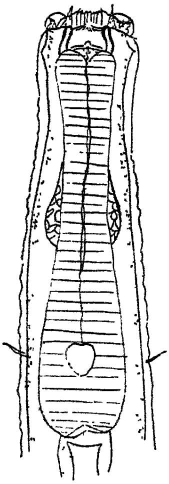
“ 97 (98) Walls of buccal capsule kneed; breadth of capsule equals its length; dorsal gutter short. Dorsal lobe of bursa very long and narrow. Tail of female distinctly demarcated, straight, fairly long and tapers gradually to a point. Males average 5·1 mm., females the same.

**Cylicostomum longibursatum,* Yorke & Macfie, 1918.

“ 98 (97) Walls of buccal capsule not kneed.

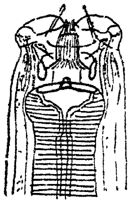
“ 99 (100) Buccal capsule very short; its walls thickest in the middle; dorsal gutter a blunt tubercle. Dorsal lobe of bursa extremely short; appendages of genital cone absent. Pointed tail of female reflexed. Males 8·5–9 mm., females 10–11 mm.

**Cylicostomum labiatum* (Looss, 1902).



33

C. longibursatum. Anterior extremity, ventral view. After Yorke and Macfie.



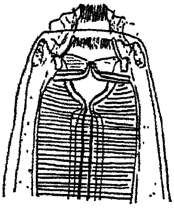
34

C. labiatum. Anterior portion, dorsal aspect. After Looss.

“ 100 (99) Buccal capsule not exceptionally short; its wall thickest at base.

“ 101 (102) Walls of buccal capsule very thick in basal half, abruptly thinning near apex; dorsal gutter prominent. Dorsal lobe of bursa strikingly elongate; appendages of the genital cone long and slender, with rounded extremities. Tail of female very short and conical. Males 12 mm., females 13–14 mm.

**Cylicostomum bicornatum,* Looss, 1900.



35

C. bicornatum. After Looss.

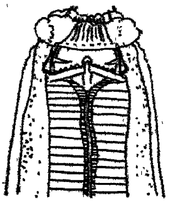
“ 102 (101) Walls of buccal capsule not abruptly thinning. Dorsal lobe of bursa short, or only moderately elongate.

“ 103 (104) Walls of buccal capsule straight and slender with a well-marked hoop-like thickening posteriorly; external leaf crown of 20 elements; oesophagus 0·4–0·6 mm. in length. Dorsal lobe of bursa elongate. Tail of female bent slightly dorsally. Males 10 mm., females 14 mm. in length.

**Cylicostomum nassatum* (Looss, 1900).

Males 7 mm., females 8·8

*variety *parvum,* Yorke & Macfie, 1918.



36

C. nassatum. Anterior portion dorsal aspect. After Looss.

"104 (103) Buccal capsule weakly funnel-shaped; external leaf crown of 35 elongated slender and pointed elements; oesophagus remarkably long (0·8 mm.). Dorsal lobe of bursa short. Tail of female straight, relatively long and strong. Males 8 mm., females 10 mm.
**Cylicostomum poculatum* (Looss, 1900).

"Since the key was in type there have come to hand descriptions of two new species of Cylicostomum by Ihle, 1920 (*Centrabl. f. Bakt.* etc., I Abt. Orig. vol. 84, p. 132–134, 562–565). *C. mucronatum* is closely related to *C. poculatum*. *C. brevicapsulatum* is characterized by having a mouth capsule extraordinarily thick, caudal end of female straight, bursa of male broad. *C. nanum*, Ihle 1920 = *C. longibursatum*, Yorke & Macfie."†

Brocq-Rousseu & Cauchemez. **Action du thymol sur les parasites intestinaux du cheval.** [The Action of Thymol on the Intestinal Parasites of the Horse.]—*Rec. Méd. Vét.* 1921. June 30. Vol. 97. No. 12 pp. 281–286.‡

The experiments here recorded were carried out in order to determine the effect of thymol on the various worms found in the intestinal tract of the horse. The worms were obtained direct from the slaughterhouse and placed with as little delay as possible in solutions of thymol of varying strengths. Other worms were placed in normal saline solution to act as controls. The solutions were kept at a temperature of 37° C. The strengths of the thymol solutions were as follows:—A. 0·769 per 1,000 (saturated solution). B. 0·50 per 1,000. C. 0·25 per 1,000. D. 0·125 per 1,000.

The following table shows the length of exposure to each of the four solutions that is necessary to cause the death of the various parasites:—

	Solution A.	Solution B.	Solution C.	Solution D.
Ascarides	1¼ to 1¾ hrs.	2 to 3¾ hrs.	5¾ to 22 hrs.	7¼ to 22 hrs. (at least).
Strongyles .. .. (*vulgaris* & *edentatus*).	1¼ to 2 hrs.	1¼ to 2 hrs.	1¼ to 3 hrs.	1¼ to 3¼ hrs.
Oxyuris curvula ..	15 mins.	15 mins.	1 to 1¼ hrs.	1½ to 5¼ hrs.
§*Spiropteria megastoma*	½ hr.	½ hr.	1 hr.	1 hr.
Taenia (*perfoliata*) ..	15 mins.	15 mins.	15 mins.	15 mins.

It was found that thymol has very little effect on Oestridae even after prolonged exposure in saturated solution. We see from these results that the drug is rapidly fatal to Taeniae and Oxyuridae, less rapidly so to Strongyles and Ascarides. and has practically no effect on Oestridae or on Spiroptera when inside the tumours.

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† [A useful bibliography of publications subsequent to 1910 is appended to the original paper.—Ed.]

‡ Abstracted by Mr. T. J. Bosworth, B.Sc., D.V.S.M., M.R.C.V.S.

§ Spiroptera are protected from the action of thymol whilst inside the tumours of the stomach wall. The results here given apply to worms outside of the tumours.

We may conclude that thymol can be successfully employed in the horse as an anthelminthic, and that its action will be greater in proportion to the saturation of the intestinal contents. It is best administered before feeding each morning for four or five days in doses of 10 gm. followed by a good drink of water. If necessary the dose may be repeated in the evening. It is probable that after a few days of this treatment most, if not all, of the intestinal parasites will have been killed. There is nothing to prevent a repetition of this series of doses after an interval of from 8 to 15 days, if required.

NAINSOUTA. **Note sur les gastrodisques. Deux cas de péritonite causés par ces parasites chez des chevaux au Sénégal.** [A Note on Gastrodiscus. Two Cases of Peritonitis caused by these Parasites in the Horse in Senegal.]—*Rec. Méd. Vét.* 1921. June 15. Vol. 97. No. 11. pp. 330–331.*

Gastrodiscus aegypticus is a trematode of peculiar shape and appearance, which reminds one of a small tortoise or a little mushroom without a stalk. It is found in the horse, ass and mule in three countries only—Egypt, Senegal and Guadeloupe. It was probably introduced into the last-named country with animals that used to be imported in large numbers from Senegal. In the same way one can account for the presence of the Senegalese tick, which is identical with the *Hyalomma aegypticus.* In view of the obscurity surrounding the evolution of the trematode, its occurrence simultaneous with that of the tick may be of interest to research workers. In Guadeloupe the tick is responsible for extensive ravages and the gastrodisc causes serious trouble, although elsewhere it appears to be harmless. Two fatal cases in which death was attributed to the latter are described.

First Case.—A horse that had previously appeared quite healthy was seized with violent intermittent abdominal pain and died six hours afterwards. A thorough post-mortem examination could not be made, but the intestines were examined and found to be much inflamed. They contained the parasites in large numbers from the pylorus to the floating colon.

Second Case.—Here again the horse appeared quite healthy up to the time of the attack, when it showed symptoms of violent colic with remissions at intervals, diarrhoea, and pain on pressure of the abdomen. Death occurred in six hours. Post-mortem examination showed the presence of a small amount of cloudy exudate in the abdominal cavity. The parietal and visceral peritoneum was highly congested and infiltrated. The most marked lesion was situated on the first part of the large colon, where a blackish zone of about 50 cm. [*sic*] was seen. On opening the intestine numerous gastrodiscs (400–500) were found lying within the blackish part of the colon, which was distinctly perforated in several places. It was thus clear that the case was one of acute peritonitis following perforation of the colon by the gastrodiscs. Although the examination was made but six hours after death, none of the parasites were found fixed to the mucous membrane and they did not show any powers of movement, so that it appears probable that they only survive their host by a very short time.

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* Abstracted by Mr. T. J. Bosworth, B.Sc., D.V.S.M., M.R.C.V.S.

VELU & DUSSERRE. **Echinococcose du coeur et du péricarde.** [Echinococcus Cysts in the Heart and Pericardium.]—*Rec. Méd. Vét.* 1921. Feb. 28. Vol. 97. No. 4. pp. 96–98. With 2 figs.*

The four cases here described were observed during the inspection of Moroccan beef.

No. 1.—The heart showed three small cysts lying close together varying at the apex in size from a pigeon's egg to a turkey's. Their walls were indurated and about 15 mm. thick. They were filled with fluid such as is usually found in echinococcus cysts.

No. 2.—An ovoid cyst attached to the apex of the heart by a short pedicle. The wall was not attached to the pericardium. It was 2 mm. in thickness and contained normal fluid.

No. 3.—Very similar to preceding, but with its wall firmly attached to the pericardium, which showed evidence of reaction even at points not in contact with the lesion. The contents consisted of creamy pus.

No. 4.—Two cysts situated at the level of the auriculo-ventricular furrow on the left surface. One was attached to the left heart and contained a faint brown creamy pus. The other, situated in front and almost on the right heart, contained pus of a distinctly brownish colour. The walls of the cysts were composed of concentrically arranged lamellae and had a thickness of 6 mm. The pressure exerted by the cysts had caused a depression of the heart muscle. (One case was noticed in which a cyst was completely embedded in the heart muscle.)

In no case did the lesions appear to have exerted any harmful influence on the state of the animal's health.

BOUIN & JAZAS. **L'échinococcose dans la région de Marrakech.** [Echinococcosis in the Marrakech District.]—*Rec. Méd. Vét.* 1920. Nov. 30–Dec. 30. Vol. 96. Nos. 22 and 24. pp. 471–475.*

Echinococcus infection is very widespread in Morocco. From observations made in the district of Marrakech it was found that the *Taenia echinococcus* itself is very commonly present in dogs, due no doubt to their eating all the animal offals which are discarded by the natives. Post-mortem examination of 71 dogs showed that 10 of them, or 14·08 per cent., were carriers of the worm. Great numbers of dogs exist in the inhabited districts. Hydatid cysts occur with very great frequency in cattle and dromedaries, but are relatively rare in sheep. The degree of infection varies greatly in the different organs. In the heart and kidneys cysts usually occur singly. In the abattoir at Marrakech hearts are very carefully searched for measles, and during one year eight cases were observed of echinococcus infection of this organ in cattle, equivalent to 1 in 1,000. Two cases were noted in pigs (6 per 1,000). The cysts are often found embedded in the substance of the myocardium and may easily pass unnoticed.

In the lungs and liver the cysts are always numerous and the numbers found are usually in proportion to the age of the animal. In some old animals these organs are literally stuffed with them, the liver especially, so that, although greatly increased in size, it may contain only a small amount of liver tissue. The health of the animals apparently does not suffer in consequence.

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* Abstracted by Mr. T. J. Bosworth, B.Sc., D.V.S.M., M.R.C.V.S.

The great difference in the frequency of infestation of bovine animals and sheep is striking, but can be explained by several reasons, In the first place shepherd dogs are rarely employed. Secondly, during the daytime the flocks are driven out from the villages to graze in the open country, where dogs are few. The pastures are frequently changed, thus allowing an interval for the sun to exert a destructive effect on the worm-eggs. In the evening they are brought back into an enclosure, but are not given any food. Cattle, on the other hand, graze in the vicinity of the villages, where dogs are very numerous, and at night are given a small ration of short straw on the ground in a yard where dogs have wandered all day.

Preventive Measures.—The methods to be adopted for the prevention of the disease consist in the destruction of all infected viscera together with a reduction in the number of dogs. The former course is difficult in view of the apathy of the natives and their disinclination to change their customs, but a law should be made enforcing the destruction of all stray dogs and limiting the numbers kept in each village.

Riley (William A.) & James (Lyle G.). **Studies on the Chicken Nematode,** *Heterakis papillosa,* **Bloch.**—*Jl. American Vet. Med. Assoc.* 1921. May. Vol. 59. New Series. Vol. 12. No. 2. pp. 208–217.

The common chicken nematode has hitherto been generally considered to be transmitted by direct infection. However, having in mind the somewhat surprising work of Stewart and of Ransom recently reported (this *Bulletin,* 1918, Vol. 6, pp. 97–103 and 1919, Vol. 7, pp. 199, 201) on the migrations undergone by the larvae of the common pig and human nematodes (*Ascaris suis* and *lumbricoides*), Riley and James were inspired to undertake a more detailed study of the development of the chicken nematode.

Heterakis papillosa Bloch 1782 (syn. *H. vesicularis* Fröhlich 1791) is the smallest of the ascarid parasites occurring in fowls (males 7–13 mm., females 10–15 mm.); the three lips surrounding the mouth are small and similar in size; the spicules of the male are very unequal in length. The most common related species found in poultry is *Ascaridia perspicillum* Rudolphi 1803, formerly known as a species of *Heterakis*; it is distinguished by the fact that the lips are of unequal size, the upper being the largest; spicules of the male are approximately equal (males 3–8 cm. long, females 6–12 cm.). These two species are the ones most commonly encountered in poultry. *H. papillosa* occurs in chickens and also in the turkey, guinea-fowl, pheasant, peacock, duck and goose. In chickens it is most frequently found in the caeca, although it is not uncommon to find it in the large intestine. Out of over 300 chickens examined by the authors at Minnesota 62·9 per cent. were found infested. Ackert (1917), at Manhattan, reports a percentage infestation of 74·1; Dujardin, at Rennes, France, 56·8; Roth (1903), at Breslau, Germany, 13 out of 230 chickens examined. Riley and James found the numbers present to vary from 3 to 113 in the fowls examined. Ackert reports an average of 34·4, but one chicken was found to contain 326 parasites. In rare cases they occur in the caeca in such numbers as to obstruct the lumen, and, according to Neveu-Lemaire, the embryos sometimes perforate the mucosa of the caeca and lodge in its walls.

Development.—Leuckart (1876) fed a healthy grown chicken with eggs containing embryos and five days later found numerous worms in the caeca. The eggs had been developing for several months (February–June). He therefore considered the development to take place direct. This experiment was repeated by RAILLIET and LUCET (1892), who fed eggs incubated for three months to a chicken found by faecal examination to be free from helminths. A few days later the bird suffered from diarrhoea, and 31 days later it was killed and 15 specimens of *H. papillosa* were found in the caeca. ERCOLANI (1873) believed that the eggs developed into rhabditiform worms in the excrement, and his feeding experiments were without results, but the organisms seen by him were undoubtedly invading free-living forms.

STEWART (1916–18) found that if a rat or a mouse was fed with the eggs of *A. lumbricoides* the larvae which escaped in the intestines wandered out of the intestines into the liver and later into the lungs, where they underwent development and finally migrated back into the intestines. In the lungs they were capable of causing a serious pneumonia, which sometimes proved fatal. It was suggested, therefore, that rats and mice might act as intermediate hosts. RANSOM and FOSTER (1917–20) repeated and confirmed STEWART's work, but more extensive experiments showed that STEWART's hypothesis with regard to rats and mice acting as intermediate hosts was untenable, for development was found to take place without the necessity for a second host, and the discharge of larvae from experimental rats and mice was regarded as " simply the expression of an abortive development in animals imperfectly adapted as hosts." Riley and James found that the common round worm of the cat (*Belascaris cati*) underwent the same cycle of development.

With regard to *H. papillosa*, the eggs are passed in large numbers with the faeces, but the mature worms are not commonly discharged from the host. The freshly-discharged eggs are unsegmented and incapable of development in a new host. Under normal summer conditions segmentation begins immediately when the eggs are placed in water, and the morula stage is reached in four or five days. The rate of development is far from uniform in the same lot. Motile embryos are present in large numbers by the 9th to the 11th day, and in this stage the eggs are infective. The early developmental stages proceed much more rapidly in a dry medium, but the embryos will not attain their full development except in the presence of moisture. Dry cultures which had attained the coiled embryo stage remained latent for six weeks and promptly became motile on the addition of moisture.

Infective eggs were fed to chickens that had been reared in the incubator and protected from any possibility of accidental infection. Within 4½ hours larvae were found to have emerged in the small intestine and at the end of 24 hours numbers were present in the caeca, they now measured 250 μ long by 18 μ in maximum width; distance from anal opening to tip 5 μ. By the 10th day the larvae in the caeca had increased greatly in length (790 μ long by 45 μ maximum width; length of tail 33 μ; alimentary canal conspicuous and gonads clearly outlined). Complete development was attained by the 24th day.

Special attention was devoted to the possibility of any migration of the larvae taking place comparable to that of *Ascaris*. Samples of blood were treated with 2 per cent. acetic acid, centrifuged, and the precipitate searched, but in no case were larvae found. The liver and lungs were separately crushed in a mortar with physiological salt solution thoroughly washed, drained and centrifuged, but again no larvae were found. The authors therefore confidently assert that the larvae of *H. papillosa* do not, in the course of their development, undergo migrations such as have been found to occur with *Ascaris lumbricoides* and *Belascaris cati*. Their development, it is stated, is simple and direct.

Further experiments were made upon the resistance of eggs to cold and the effect of infestation upon the hosts. It was found that even when infested birds were frozen at temperatures ranging from 0° F. to -10° F. for six months a large number (about 50 per cent.) of the eggs in the caecal contents were still capable of development. A number of the eggs appeared, however, to be affected injuriously.

The symptoms of internal parasitism are loosely dealt with in the literature upon poultry husbandry. Diarrhoea is a frequently mentioned symptom. In a number of the authors' experimental birds diarrhoea was clearly evident, but this symptom occurs so commonly in young chickens that its appearance cannot be considered as evidence of worm infestation. The caeca of chickens infested experimentally showed a marked inflammation, and even in the older birds inflammation and thickening of the walls of the caeca were seen to result from heavy infestation. The authors are convinced, nevertheless, that however vague the symptoms, the worms are a cause of unthrifty condition and a source of loss to the poultryman. When the birds are crowded, or when the seasonal conditions are favourable, the infestation becomes heavy and losses may be direct and serious. GALLI-VALERIO (1897) reported the occurrence in a pheasant of caecal tumours caused by the larvae and this condition was studied in detail by LETULLE and MAROTEL in 1908.

The authors' work on control measures is of particular interest. Remedial treatment is of little real efficacy. Chickens subjected to the tobacco treatment recommended by HERMS and BEACH (1916) were found on post-mortem examination to be on the average as heavily infested as other birds in the flock. HALL and FOSTER (1918) experimented with six chickens and found that this treatment removed 30 out of 162 worms (19 per cent. efficacy). Such results are wholly negligible as a method of eradicating infestation from a flock. It is possible that the treatment would be more effective in removing *A. perspicillum* from the small intestine than it would *H. papillosa* from the caeca.

Failing remedial measures, the next point of importance is to find out whether there is some chemical which when sprinkled on the ground will destroy the eggs and render the poultry yard safe. The great majority of the chemicals recommended for this purpose have already been shown to be useless. The most constantly occurring recommendation of this kind is so-called disinfection by sprinkling the ground with a 1 per cent. solution of sulphuric acid. Riley and James' experiments showed that eggs placed directly in and kept in such a solution readily developed to the infective stage. Moreover, even if the sulphuric acid actually killed the eggs immersed in it, sprinkling the ground or even puddling it with a chemical would be of very doubtful value.

HERMS and BEACH (1916) recommended disinfection by the use of a 1 : 1,000 solution of perchloride of mercury, and an experiment of theirs is quoted in which it was claimed that sprinkling with this solution at the rate of 1 gallon for every 10 square feet of ground, the quantity necessary to penetrate the soil to a sufficient depth, viz., 2 inches, had rendered the infested run quite safe. Riley and

James, however, found that the eggs of the worm could be reared to the infective stage with the utmost ease in a solution of perchloride of mercury in this strength, and the same was true of *A. perspicillum.* The good results claimed to have been obtained by HERMS and BEACH were without doubt due to the thorough cleansing which they gave to the poultry yard and houses in their experiments, while the heavy infestation in the control lot must have been due to the lack of such treatment.

"Trouble from *H. papillosa* and from other intestinal parasites of poultry," the authors state, "is best avoided by the selection of clean, dry runs and well-lighted poultry houses kept thoroughly clean. The ground should be changed every two or three years. Where this is impossible they should be deeply spaded or ploughed, so that the entire surface soil may be turned under. This will not obviate the possibility of parasitic infestation, but will very greatly reduce it."

CHRÉTIEN (A.). **Onchocercose de la région sternale chez un boeuf danois.** [Onchocercosis of the Sternal Region in a Danish Beast.]—*Rec. Méd. Vét.* 1921. March 30. Vol. 97. No. 6. pp. 131–133.*

The lesion was found in the sternal region of a frozen carcass of beef exported from Denmark. It was of the size of a large apple and involved chiefly the fatty tissue on the inferior surface of the sternum at the level of the second and third costal cartilages. More or less spherical in shape, it appeared on section to be composed of a large number of whitish caseous masses which had lost all trace of their original structure but contained innumerable fine calcareous granules scattered irregularly throughout them. These caseo-calcareous masses were very variable in size and shape. Some were distinctly nodular, others flattened, while those in the peripheral part were generally very small in size and appeared to be irregularly cylindrical. These elements were separated from one another by a dense tissue of a glistening whitish colour, and of varying thickness, but not exceeding more than a few millimetres on an average. The lesion was bounded externally by a similar tissue. No communication existed either with the exterior or with the thoracic cavity. The sternum and pleura were normal and the lymphatic glands showed no alteration. No other lesions of onchocercosis were present and the carcass was well nourished and of good quality.

Histologically the lesion appeared composed of a series of completely degenerated nodules becoming smaller in size from the centre outwards. In the peripheral region some of them were perfectly cylindrical in shape. After decalcification the nodules appeared quite homogeneous and stained a light violet colour with haematein. They did not show any cellular elements, however, either intact or in the process of degeneration. The tissue in between the nodules appeared to be the result of a subacute or chronic inflammation. It was composed of interlacing fibres infiltrated with eosinophile cells, with occasional blood-vessels, and its inner surface was lined in places with a faint epithelioid layer. The tissue on the outside of the lesion was of precisely the same structure, so that the whole thing may be looked upon as a dense mass enclosing nodules of varying size, which had completely undergone a caseo-calcareous degeneration. The surrounding tissues appeared normal except for considerable thickening of the walls of some of the neighbouring vessels.

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Microscopical examination failed to reveal any causal organism. No tubercle bacilli could be found. A guinea-pig inoculated subcutaneously with ground-up substance from the lesion did not show any reaction. No worms either in the adult or larval stage could be seen, and no moulds were present. The lesion cannot have been tuberculous since no bacilli could be demonstrated by microscopical examination or guinea-pig inoculation. Further, no giant cells were present. The numerous eosinophile cells found in the tissue between the nodular masses suggest a parasitic lesion, and the cylindrical caseo-calcareous elements round the periphery would indicate a nematode. The lesion very much resembles those of onchocercosis met with in Australia and New Zealand, which frequently necessitate condemnation of the brisket of beef. An identical lesion has not previously been reported as occurring in Europe, but it seems probable that this case is more likely one of onchocercosis than of any other condition.

SCHWARZ (Benjamin). **Effects of X-Rays on Trichinae.**—*Jl. Agric. Res.* 1921. Mar. 1. Vol. 20. No. 11. pp. 845–854.*

This article is a description of experiments conducted to ascertain the effects of exposure to X-rays on trichinae, with a view to the practical application of X-ray radiation to the destruction of trichinae in pork. A number of hogs were infected artificially by feeding them on trichinous pork, and were then killed after an interval of about one month. Their flesh was submitted to exposure to X-rays, after which it was chopped up and fed to rats in order to determine the effects of the exposure. In a few cases portions of the meat that had been exposed to X-rays were digested in an acidified solution of scale pepsin, the decapsuled larvae were examined, and the results were compared with those of the feeding experiments. Unless they died as a result of infection with trichinae, the rats were killed at various intervals, and examined for evidence of infestation with the parasites.

The results show that encysted trichinae are injured by relatively heavy dosages of X-rays. The injuries are not visible in the encysted or artificially decapsuled larvae as structural or functional disturbances, but become apparent only when the larvae reach a suitable host in whose intestine they are normally capable of continuing their development. Trichinae from meat that has been exposed to strong dosages of X-rays undergo rapid granular degeneration in the intestines of suitable hosts. When, however, they have been exposed to lower but still injurious dosages, they are able to continue development in the intestines of suitable hosts, but do not attain structural and functional sex maturity. The sex cells appear to be atrophied, and no evidence of successful copulation can be found. The trichinae appear also to exhibit considerable variation in their susceptibility to X-rays, since certain dosages injured some parasites and failed to injure others. Small dosages apparently had little or no effect on the subsequent development of the parasites.

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These results do not warrant any definite conclusions, for, assuming that a reliable practical method of destroying the vitality of the sex cells in trichinae by means of X-ray treatment of infested meat can be perfected, unless the treatment has the effect of diminishing the injurious action of the intestinal stage of trichinae upon the host it cannot be considered a satisfactory prophylactic measure.

HALL (Maurice C.). **Examining Feces for Parasites and Parasite Eggs.**—*Vet. Med.* Chicago. 1921. Sept. Vol. 16. No. 9. pp. 52-54.

In this paper Hall describes simple methods by which the veterinary practitioner may determine the presence of parasites or their eggs in faeces. Wherever practicable the faeces should be screened. Those of the dog, cat, and pig may be broken up in water and screened without difficulty. Sheep and goat faeces are much more difficult to manipulate though they can be screened to advantage in looking for parasites. Cow manure is easily screened, but its bulk makes the examination of a day's manure a difficult task. Horse dung is too coarse to screen successfully in the amounts passed in one day and must be examined by being carefully picked apart by hand. The nature of the screen used depends on various circumstances. Where few examinations are made and little apparatus is available a piece of cheese cloth may be stretched over hoops or a bucket top to make a screen. Where routine examination of faecal matter is undertaken, wire screens, of copper or brass, of assorted sizes of 6-100 mesh apertures to the inch are of value. After the faeces have been broken up thoroughly by soaking them in water and shaking, they are poured through the screen or screens and each screen is then put in a glass dish containing water and examined for parasites.

When the eggs of parasites are searched for by microscopic examination, the simplest method is to make a smear of a small piece of faeces on a slide, rub it up with a little water to form a uniform paste, and examine under the microscope. This method gives satisfactory evidence when there is gross infestation, but it is not a delicate method, and cannot be depended upon to detect light infestations. A simple method that will give a high degree of concentration is as follows:—

The faeces are broken up, screened through a set of screens placed in a rack with the coarsest screens at the top and the finer ones at the bottom, the material passing through all the screens being caught in a suitable tray or dish. After standing for about a minute the upper half of the fluid is decanted away and replaced by clean water. This process is repeated every minute until the soluble colouring matter and floating flocculent matter is all poured away and the water stands clear on the sediment at the bottom. The water is then decanted away until only a little is left on the sediment, and this is shaken up and poured into a centrifuge tube until the tube is full. The tube is then set in a rack until the examination is performed. In the course of this manipulation all faecal material which is too coarse to pass through a screen with 100 apertures to the inch has been eliminated by the screens, while, on the other hand, such screens will allow the passage of the largest parasite eggs one need take into consideration, and the soluble colouring matter and floating flocculent material eliminated by the washing and sedimenting. What is then left is the the eggs and other material of about the same size as the eggs or other smaller and heavy material. When there is a bottom sediment, evidently composed of sand, in the tray or dish used to catch the faeces passing through the screen, this should be allowed to remain in the dish and not rinsed into the test-tube, as the eggs are lighter and will be on top of such a sediment.

By this method a high degree of concentration is obtained, and it is applicable to a wide range of animals. Hall states that there are many published methods for examining faeces for parasite eggs, but most of them are intended only for human faeces, which is a very special case, and some of them only for hook-worm eggs, which is again a very special case. They are more or less elaborate, although sometimes very useful within the range of their applicability. For the purposes of the veterinarian the simple technique given here and intended for faeces of any sort and the detection of parasite eggs of any sort is recommended. It has to be borne in mind, however, that failure to find eggs in faeces with any technique is not conclusive proof that no worms are present. In very light infestations the few eggs present in faeces may not be observed in the preparations examined. Where only male nematodes are present there will be no eggs in the faeces. Where only larvae or young worms are present there will be no eggs, and egg production may be interrupted or terminated by old age, anthelmintics, or accidents.

MARCENAC. **Dermatose par** *Ixodes ricinus.* [Dermatitis caused by *Ixodes ricinus.*]—*Rec. Méd. Vét.* 1921. Jan. 30. Vol. 97. No. 2. pp. 58-61.*

Symptoms of this condition are first noticed about 24 or 36 hours after horses have been admitted to infested land, which is usually covered with heather or broom. If the hand be passed over the animal's body, indications of a dermatitis are obtained in the shape of pimples and oedematous patches. After a short time thick yellow scales are seen, and the hair becomes matted in tufts that easily come away when pulled, leaving an irregular smooth surface which is moist and painful. Adult male and unfertilized female ticks come away with the scabs, but most of the fertilized females, which are engorged and of enormous size, have their rostra firmly implanted beneath the skin and are only detached with difficulty. The ticks are found chiefly in places where the animal cannot reach them with its teeth (parotid region, jowl), or where the skin is fine (elbow, belly, inside the thigh and forearm). They are not usually present on the trunk above a horizontal line passing through the junction of the middle and lower thirds of the ribs, nor on the limbs below the middle of the forearm and gaskin. The irritation set up is very marked and the animals bite themselves freely. Some subjects become so nervous and excited that they are very difficult to approach. In severe cases there are numerous cutaneous lesions which, by confluence, become converted into large, hairless, irritable patches, that heal but slowly and are analogous to the effects of a strong blister. The lesions on the upper part of the limbs may cause marked oedema accompanied by lameness. Provided treatment is applied early, the lesions terminate rapidly without complications. Prompt attention should be given not only to prevent extensive damage to the skin, but also to ensure the destruction of the female ticks before they drop off in readiness to lay their eggs. Complications may result in the shape of painful miliary abscesses in cases where the rostra are left under the skin after removal of the ticks by an attendant or by the horses' teeth.

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* Abstracted by Mr. T. J. Bosworth, B.Sc., D.V.S.M., M.R.C.V.S.

From the point of view of prevention, the possible infestation with ticks must be considered whenever horses are obliged to cross moory or waste land. In such cases it is advisable to wash the body over with a warm solution of cresyl, or to rub it with a sponge dipped in benzine and then rung out so as to contain only the vapour.

A satisfactory curative method consists in sulphur fumigation. One passage of 30 minutes in the chamber is sufficient to completely free the animals of all the ticks they carry. In advanced cases attention to the lesions is necessary in addition. Eradication by hand is not recommended owing to the length of time involved and the difficulty experienced in extracting the ticks whole.

MYCOTIC DISEASES.

FORGEOT. **Essais de traitement de la lymphangite épizootique par les cultures, chauffées, de Cryptocoques.** [Attempted Treatment of Epizootic Lymphangitis with Heated Cultures of the Cryptococcus.] —*Rec. Méd. Vét.* 1920. Nov. 30–Dec. 30. Vol. 96. Nos. 22 and 24. pp. 489–492.*

This article gives a detailed account of the treatment of 20 horses suffering from extensive lesions of epizootic lymphangitis. The vaccine employed was prepared by NÈGRE and BOQUET from a two months old culture of the cryptococcus and was made up in a strength of ½ mgm. per cc. of normal saline solution. The first animal received an initial dose of 1 cc. subcutaneously. On the following day it was noticed that the lesions showed congestion and discharged more freely. Further injections were made every eight days, the dose being increased by 1 cc. each time up to a maximum of 5 cc. A complete cure resulted in six weeks. The inoculation causes a local lesion at the point of injection, which is hot, painful and oedematous, and about the size of the palm of one's hand. Partial reabsorption takes place, followed by the formation of an abscess which rapidly heals after evacuation.

The second animal was treated exactly similarly, but showed no improvement after seven inoculations had been performed. It was therefore decided to try the effect of a vaccine of ten times the strength (*i.e.*, 5 mgm. of culture per cc.), which was administered in the same doses as before, beginning with 1 cc. After seven injections the animal was cured.

In subsequent cases the stronger vaccine was employed, the only other treatment consisting of puncture of the abscesses as they arose and application to the ulcers of a solution of methylene blue in glycerine (1–50).

Of the 20 animals treated 13, or 65 per cent., were cured. Of the remainder 3 were in such an advanced stage before treatment was begun that it was unreasonable to expect good results. The average duration of the treatment was 57 days. The general health of the animals was unaffected by the vaccine. No relapses have occurred. This method of treatment is easily carried out, promises good results, and is worthy of further trial.

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* Abstracted by Mr. T. J. Bosworth, B.Sc., D.V.S.M., M.R.C.V.S.

Cocu (M.). **Traitement de la lymphangite épizootique.** [Treatment of Epizootic Lymphangitis.]—*Rec. Méd. Vét.* 1920. Nov. 30–Dec. 30. Vol. 96. Nos. 22 and 24. pp. 501–502.*

Cocu records a case of epizootic lymphangitis with very extensive lesions that was successfully treated by the use of drugs by Bridré and himself. Confluent lesions were present in both fore limbs, together with very thick corded lymphatics, on the scrotum and sheath, round the lips and nostrils, and on the pituitary membrane. The internal surface of one of the tibias showed a large exostosis due to the deeper layers of the periosteum, or perhaps the bone itself, being involved. With the exception of opening a few abscesses, treatment was purely medical and consisted of intravenous injections of novarsenobenzol and potassium iodide. A complete cure was affected in three months. After five years the animal was perfectly healthy and the exostosis, though still noticeable, was considerably reduced in size.

The author also mentions a second case with advanced confluent lesions that yielded to medical treatment alone, of which the exact details are not available, but which consisted in injections either of a solution of biniodide of mercury or of the double solution of methylarsenate of soda and benzoate of mercury, which has proved effective in the treatment of pernicious anaemia in horses.

Descazeaux (M.). **Le traitement de la lymphangite épizootique par le novarsénobenzol.** [Treatment of Epizootic Lymphangitis by Novarsenobenzol.]—*Rec. Méd. Vét.* 1921. June 30. Vol. 97. No. 12. pp. 274–278.*

The author claims to have been successful in treating cases of epizootic lymphangitis with injections of novarsenobenzol. Eighteen cases were subjected to this method, of which eight had not received any previous treatment. The other ten had received injections of the cryptococcus killed by heat, and, excepting two, which appeared incurable, had shown improvement as a result.

The dose of novarsenobenzol was varied according to the susceptibility of the animals to the drug, doses of 1½, 2 or 2½ gm. being given daily, until a total of from 6–8 gm. had been given, corresponding to the normal therapeutic dose of 0·015 gm. per kilogramme body weight. This series of injections was repeated after eight-day intervals. A short negative phase was seen to occur after the first series, followed by a positive phase which lasted until the animal was cured. Four series were found to be necessary in cases of average severity, whereas only two were required for mild ones. Recovery took place in all the cases.

It was noticed that the earlier the treatment was begun the quicker was the animal cured. It is therefore important to make an early diagnosis and begin the injections at once. Attention should also be paid to any wound present at which the cryptococcus may have gained access to the body. For this purpose a 45 per cent. solution of formol or novarsenobenzol powder proved to be a useful application.

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Complications.—In two cases during the healing process, when the corded lymphatics and nodules had disappeared, several abscesses were seen in the neighbourhood of the cicatrized lesions, which were found to contain only a few cryptococci but numerous staphylococci (*aureus* and *albus*). These healed after evacuation without further treatment. In another case a large angry-looking wound was present, which at first showed signs of healing but later became worse and suppurated freely. The discharge contained numerous organisms—staphylococci, streptococci, bacilli. At the same time fresh corded lymphatics and buds appeared, the pus of the latter showing cryptococci and staphylococci. It therefore seems that staphylococci can, at a given moment, complicate lesions due to cryptococci and retard their healing, and probably other organisms may have the same effect. On these grounds it would appear reasonable to combine vaccine therapy with novarsenobenzol in intractable cases. Bacterial complications (staphylococci especially) undoubtedly play an important part in the pathogenicity of epizootic lymphangitis. The history of 24 animals suffering with the disease revealed the fact that all had been treated from one to four months previously for wounds, which, when the lymphangitis appeared, proved to be the starting point of the corded lymphatics. In all these wounds staphylococci predominated, and it is probable that their effect was to render the animal susceptible by means of toxins secreted in the wound itself, which, becoming diffused in the neighbouring lymphatic network, were favourable to the development of the cryptococcus, which was no doubt inoculated at the same time. Similarly, in the course of the disease, reinfection of the wound with other organisms is liable to cause an aggravation of the effects of the cryptococcus. These considerations may explain the fact that autogenous vaccines made from the pus sometimes seem more efficacious than others, because they at the same time vaccinate against bacteria which may be complicating the disease.

ROGER (J.). **Au sujet de la présence d'un cryptocoque dans certaines dermites granuleuses.** [The Presence of a Cryptococcus in Certain Forms of Granular Dermatitis.]—*Rec. Méd. Vét.* 1921. July 30. Vol. 97. No. 14. pp. 316–318.

With the approach of summer the author observed in certain districts in the south of France a condition known to the local veterinarians as "summer sore," characterized by its slow healing during the hot weather, presence of soft buds which easily bleed, a serous pus, fibrinous exudate, caseous granulations, and intense induration of the dermis. This induration is held to be characteristic and enables one to distinguish the disease easily from simple sores. Certain horses exhibit these sores every year and the lesions are apt to recur at their former seats. Sometimes small secondary centres are formed around the principal centre, which would appear to indicate that the condition has a tendency to spread. In some cases the induration is so marked that the lesion resembles an ulcerating tumour.

At the present time "summer sore" is considered to be the result of the irritation produced by the larvae of a gastric Habronema transported by the domestic fly on to the surface of the sore. Roger, however, found no such larvae in the sores that came under his observation, but, on the other hand, all revealed the presence of a yeast-like organism (Blastomycetes), which, in the meantime, he regards as a cryptococcus. If a smear is made from the pus of a recent sore one finds scarcely any bacteria, but on the other hand a large number of large mononuclears and polynuclear leucocytes, together with a rounded, oval, or pear-shaped element, encapsuled and of varying size, free or included in the phagocytes. Some of these structures were scarcely larger than eosinophile granules, but could be easily differentiated by the presence of a capsule, although some were as large as RIVOLTA's cryptococcus of epizootic lymphangitis. The free-lying parasites were collected in more or less considerable masses of various shapes. They were usually so numerous that there was no difficulty in finding them, and the caseous granules seemed to be composed almost entirely of the structures. The best method of staining is by means of a methylene blue eosin stain after rapid fixation with alcohol ether mixture. Three zones can be sometimes easily distinguished, viz.: (1) round or oval central zone staining deeply with eosin; (2) a refractile capsule around this zone; and (3) a bluish zone encircled by a border of deeper blue. This last zone was not constantly found. The parasites were not stained with dilute fuchsin. This structure was found in 16 horses, some of which showed several summer sores, but none of them were complicated with lymphangitis. [It would be interesting to have had reported a more complete study of this condition.—J. T. E.]

BACTERIAL DISEASES.

VELU (H.). **Le charbon bactéridien chez le porc au Maroc.** [Anthrax in the Pig in Morocco.]—*Bull. Soc. Path. Exot.* 1921. July 13. Vol. 14. No. 7. pp. 359–361.

In Morocco, anthrax in the pig usually shows itself as an affection involving the pharyngeal region (so-called "gloss" anthrax), but sometimes septicaemic forms are seen which are difficult to differentiate from the other so-called "red" diseases, especially inasmuch as the spleen is not enlarged and the blood reveals very few bacilli. The disease therefore undoubtedly frequently passes unobserved.

In this note, Velu records an exceptional type of infection, viz., a pulmonary form which hitherto appears to have been described only by PASSERINI and then by WYSSMANN, E. (1907) in the pig. The subject was a nine months old sow which showed ill-defined symptoms, intense fever, slight swelling of the neck, marked dyspnoea and livid spots on the skin. The animal died in 48 hours. Hardly any congestion was found in the various visceral organs. The spleen was normal; there was a slight swelling of the pharyngeal lymphatic glands. However, in the thoracic cavity there was a distinct pericarditis and pleuritis, and the right lung was the seat of an intense grey hepatization recalling in appearance somewhat the lesion of contagious bovine pleuro-pneumonia. Anthrax bacilli were recoverable from the pleuritic fluid, but could not be obtained in culture from the heart blood nor seen in smears from the blood, gland juice, kidneys, or spleen.

BESREDKA (A.). **Vaccination par voie cutanée. Charbon : cuti-infection, cuti-vaccination, cuti-immunité.** [Vaccination by Way of the Skin. Anthrax: Cutaneous Infection, Vaccination and Immunity.]—*Ann. Inst. Pasteur.* 1921. July. Vol. 35. No. 7. pp. 421–430.*

The classical method of anti-anthrax vaccination, which is so successful in the larger animals, fails almost always in the case of the small laboratory species. If more than the minimum lethal dose ($\frac{1}{8}$ cc. of second vaccine in the guinea-pig or the least fraction of a cc. in the rabbit) is given, it is rare for these animals to offer any resistance, no matter how carefully and gradually one has attempted to immunize them.

The author had noticed, however, that a strong local reaction is set up in the guinea-pig by painting a shaved area of the skin with a swab soaked in the first anthrax vaccine. On the following day a marked characteristic inflammatory reaction appears, which shows no tendency to spread. After persisting for four to six days it gradually abates, the skin becoming pale and supple again. The application of the second vaccine to a normal guinea-pig, on the other hand, causes a much more marked reaction, which does not remain localized, but spreads more and more into the surrounding tissues until it becomes generalized, causing the death of the animal in about four days. If, however, a guinea-pig, which has recovered from the effects of the application to its skin of the first vaccine is subsequently treated in a similar manner with the second vaccine the reaction remains circumscribed and in a few days the skin becomes normal again. After an interval of ten days the application of a virulent bouillon culture of anthrax to the shaved skin of such an animal will cause a very marked reaction, but the animal will recover and will then withstand subcutaneous injection of repeated and increasing doses of culture, and have thus acquired a very solid immunity. In the same manner the rabbit can be vaccinated against anthrax, and in this animal it is best to begin with the second vaccine, followed after an interval by virulent culture. When the skin has regained its normal appearance the immunity is sufficiently strong to afford protection against the organism, by whatever channel it may be introduced.

A similar immunity may be set up by intradermic injection, *i.e.*, into the thickness of the skin itself.

Having succeeded in immunizing these small laboratory animals against anthrax, the author withdrew blood from them and used the serum for injection into normal guinea-pigs, to ascertain whether it would confer on them any protection against inoculation of the organism, but it proved to be entirely useless for this purpose, the disease taking exactly the same course in those animals that had received serum as it did in the controls. Apparently, therefore, the immunity set up by cutaneous vaccination is not due to the production of specific antibodies in the blood.

It then occurred to the author that possibly in the guinea-pig there is only one organ for which the anthrax bacillus has a real affinity and in which it can establish itself and multiply, this organ being the skin, outside of which it is bound to be destroyed wherever it enters the body. An animal inoculated with anthrax intraperitoneally or intratracheally succumbs in the same manner as one inoculated cutaneously or subcutaneously, but this is because in inserting and withdrawing the needle one is bound to wound the skin and infect it with the bacillus, and it is this infection of the skin which determines the death of the animal. If this supposition be correct, then it should be possible to inject anthrax bacilli into guinea-pigs with impunity, provided one avoids contaminating the cutaneous structures with the organism. Experiments which were performed proved that, when this precaution is taken, it is possible to inject many times the ordinary fatal dose either into the trachea, peritoneum or veins without causing the animal any inconvenience. The operation is a delicate one and may not always succeed. Oedema appearing at the point of inoculation is a clear indication of faulty technique.

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* Abstracted by Mr. T. J. Bosworth, B.Sc., D.V.S.M., M.R.C.V.S.

These results show that the susceptibility of the guinea-pig to anthrax is mainly, if not entirely, confined to its skin. It is therefore easy to understand how a guinea-pig which has been vaccinated cutaneously shows such remarkably powerful immunity, and, further, how a local immunization, confined to the skin alone and not due to the development of antibodies in the blood, can confer an immunity on the whole animal body. It is because the guinea-pig possesses but one sensitive organ, viz., the skin, and as soon as this has been immunized the animal has nothing to fear. Whether virus be subsequently introduced by way of the peritoneum, respiratory passages, or even the blood stream, it is opposed firstly by the barrier of the vaccinated skin, and secondly by the natural refractory state of the other organs.

A very interesting point is the fact that a guinea-pig which has received very large doses of anthrax bacilli injected into the peritoneal cavity or into the trachea (with precautions to avoid contamination of the skin) does not develop any resistance to anthrax as a result. If it is subsequently inoculated with anthrax by subcutaneous injection in the ordinary way it succumbs in just the same manner as a control animal. The bacilli which penetrate otherwise than by the skin or subcutaneous tissue evidently pass almost unnoticed by the animal, being immediately phagocyted and digested. They must be totally and rapidly destroyed, for they leave no effect upon the animal.

The guinea-pig is commonly cited as being very susceptible to anthrax and incapable of being immunized against it. The classical reason assigned for the impossibility of immunizing the animal against the bacillus is that it is remarkably susceptible to it. It is now seen, however, that the guinea-pig is very resistant to anthrax, provided the organism is not introduced into the skin, and, moreover, that immunization is easy if care is taken to vaccinate the skin. When dealing with an infectious or toxic agent it is not sufficient to inquire whether a given animal is susceptible. An endeavour should be made to determine whether it possesses an organ particularly sensitive to the agent in question, and, if so, whether by vaccinating that organ the animal may not be completely immunized.

DISEASES DUE TO FILTERABLE VIRUSES.

ARLO (J.). **La rage canine au Soudan français.** [Canine Rabies in the French Soudan.]—*Bull. Soc. Path. Exot.* 1921. July 13. Vol. 14. No. 7. pp. 368–373.

Rabies has been proved to exist in dogs in the French Soudan by a number of authors, but the virus seems to exhibit certain peculiarities, particularly that of low virulence, so that examples of transmission to the human subject are extremely rare. In 1919 Arlo commenced studying the native virus and first endeavoured to obtain a fixed virus. His attempts, however, proved fruitless. The brain of one dog gave fatal rabies to a rabbit after sub-dural inoculation, but inoculation of a second rabbit with material from the brain of the first rabbit remained negative. Virus from the brain of a second dog was passaged through a series of rabbits, but after about 13 months it died out, and in the meantime there was no evident shortening of the period of incubation in the inoculated rabbits; in fact, the period increased from 21 days for the first rabbit to 128 days for a rabbit inoculated six months later. Some of the rabbits remained alive in spite of inoculation. Likewise material obtained from the Dakar Laboratory could not be exalted in virulence, and some of the samples proved quite inactive. The temperature of inoculated animals was taken for some time twice daily, but only in one case was a rise noted prior to death. Glycosuria could not be detected. In the case of one rabbit the virulence of the medulla, salivary glands, and sciatic nerve were compared. The medulla only proved virulent, and the animal inoculated with it died in 74 days. In 1910 BLANCHARD noted that a rabbit which had been inoculated with rabies during the preceding year, and had remained healthy, succumbed with typical symptoms of this disease following upon the application of cowpox virus to the dorsal region. Arlo repeated this experiment upon three rabbits, with negative results.

The author was unable to detect the presence of Negri bodies in the hippocampus of any of his animals. The form of rabies occurring in the Soudan does not appear to be transmissible to man, and a child about four years old that had been bitten on the face near the lips remained healthy subsequently. [See, however, preceding number of this *Bulletin.* pp. 173–174.]

VAN SACEGHEM (R.). **Procédé pour la production rapide du sérum contre la Peste bovine.** [A Rapid Method of Producing Anti-rinderpest Serum.]—*Bull. Soc. Path. Exot.* 1921. July 13. Vol. 14. No. 7. pp. 367–368.

In hyperimmunizing serum-producing animals the author resorts to direct transfusion of virulent blood from rinderpest-affected animals. The procedure is simply carried out by connecting a trocar placed in the jugular vein of the diseased beast with an india-rubber tube which is attached to a trocar placed in the jugular vein of the animal which is being hyperimmunized. In order to facilitate the flow of blood, the animal which is the source of the virulent blood is placed about five feet above the level of the ground and pressure applied to its jugular vein below the trocar. The pressure thus obtained is also sufficient to perform a subcutaneous inoculation with blood. Three or four litres of blood can thus be transfused easily in five minutes intravenously.

[The author, working in the Belgian Congo, does not state how many cattle he has subjected to this process. It is our belief that elsewhere workers have found this method of hyperimmunization result in the production of severe symptoms of shock, and often death, in the injected animals —ED.]

i. CROVERI (P.). **A propos de la vaccination contre la peste bovine par le procédé de Schein.** [Vaccination against Rinderpest by SCHEIN'S Method.]—*Bull. Soc. Path. Exot.* 1921. Jan. 12. Vol. 14. No. 1. pp. 9–15.

ii. SCHEIN (H.). **Vaccination contre la peste bovine.** [Vaccination against Rinderpest.]—*Bull. Soc. Path. Exot.* 1921. July 13. Vol. 14. No. 7. pp. 361–367.

i. In 1917 SCHEIN described a method of conferring active immunity upon highly susceptible animals, such as the buffaloes of French Indo-China, differing from the original method of sero-vaccination described by KOLLE and TURNER, inasmuch as a small dose only, viz., 1 cc. of a 1 : 1,000 dilution of virulent blood was injected at the same time as the protective dose of serum. [See this *Bulletin*, 1918, Vol. 6, No. 1, p. 32.]

Having in mind the undeniable superiority of such a method, Croveri carried out a few experiments with it upon Somaliland cattle, but the results were, however, disappointing, as a solid immunity was not set up against subsequent test inoculations. It would seem that the good results claimed by SCHEIN were in reality probably due to contamination with the virus from outside sources, while the serum injections still maintained a passive immunity. Moreover, Croveri claims highly successful results following upon the use of the original form of double inoculation in Italian Somaliland (0·6 cc. virulent blood withdrawn on the fifth day of the disease and 25–50 cc. of a serum according to the weight of the animal). For example, out of 1,000 adult animals vaccinated a febrile reaction was obtained in all, with subsequent active immunity against the disease. Again, the susceptibility of cattle in Somaliland appears to be even greater than that reported by SCHEIN in Indo-China; thus, from 90–95 per cent. of Somaliland cattle succumbed in the course of outbreaks, especially during the rainy seasons, whereas in Indo-China the mortality was said to be 43 among buffaloes and 29 per cent. among cattle. The percentage of animals which exhibited reactions in SCHEIN'S trials was much below that observed by Croveri after the use of the original method.

In Croveri's experiments four animals vaccinated according to SCHEIN'S method did not react, but three months later, after being subjected to the original method of vaccination, they showed typical reactions. It would thus appear that they had not been actively immunized as the result of the first inoculation. SCHEIN, however, expresses regret that the author had not kept any controls for his first and second experiments, but simply assumed that the virulent blood was at its maximum activity on the fifth day of the disease. Croveri maintains that the virulent blood thus injected could be regarded as a good sample, inasmuch as it contained a strain of virus which had been maintained at the Serum Institute for five years and had been maintained by passage every eight days and was highly virulent and infective. At the time of the first inoculation the virus was used for infecting four virus-producing calves, which fell ill three days afterwards, and for the vaccination of 50 calves, which subsequently gave typical reactions. Further, as regards the second test, viz., by vaccination according to the original method, controls would only have been necessary had the calves exhibited no reaction. Croveri thus concludes that the results fail to lend any confirmation to SCHEIN'S conclusion.

ii. Schein contends, however, that CROVERI'S experiment is inconclusive, as he did not utilize at least one control in the form of an animal inoculated with 1 cc. of the 1 : 1,000 dilution of blood, without simultaneous injection of serum, in order to ascertain the infectivity of this dilution. Again, the quantity of serum injected by CROVERI might have been so large as to mask a reaction due to the small dose of Somaliland virus. [Schein's argument displays some weakness, particularly when he speculates upon the possibility of a partial immunity being conferred by CROVERI'S first injection.] Schein maintains it would have been difficult to take account of febrile reactions in the animals vaccinated by him in the jungle. After the use of the original KOLLE-TURNER method in French Indo-China, from 1–3 per cent. of cattle died, 7–10 per cent. became seriously ill, 20-30 per cent. showed clinical symptoms, 40–50 per cent. showed simply a fever which subsequently conferred immunity; 6–10 per cent. are naturally immune, and 6–7 per cent. fail to contract the disease and are thus not vaccinated. If, therefore, 30–40 per cent. of the buffaloes and 40–50 per cent of the cattle become apparently clinically affected, then at least 40–50 per cent. might be assumed to be fevered. Moreover, reactions were always obtained in the laboratory following upon the injection of a dose of 1 cc. of a 1 : 1,000 dilution of virulent blood, with or without serum. In support of his contention that this small dose of blood was in reality infective, Schein further quotes the cases of an establishment where the herd had been completely exterminated by rinderpest. After the lapse of a sufficient period of time to bring about the disappearance of the virus, 65 working oxen were purchased from a healthy district and vaccinated—using diluted virus. All gave a temperature reaction in four days (39°–40° C.), and 12 presented clinical symptoms. Three of these died in 30 days. The remaining animals proved to be immune in spite of the fact that they were exposed subsequently to infection. [Such an argument is not in conflict with CROVERI'S argument regarding the possibility of external contamination.—ED.]

Schein states that in French Indo-China attempts at vaccination were carried out by him on the borders of the infected zone in villages separated from each other by a distance of about three miles at least. The animals belonged to about 250 different owners possessing at most five or six animals each. The disease had just appeared in one village, causing two deaths. When serum alone was employed in such circumstances about 20 animals would be noticed ill in about 10 days after the operation, and thenceforward the disease developed for two or three months as on virgin ground. Thus in Indo-China the use of serum alone as a preventive had been discontinued entirely. On the other hand, in the villages in which Schein adopted his method of conferring active immunity, all the animals which exhibited clinical symptoms were attacked at the same time, viz., in from eight to ten days after the injection, and the disease lasted from eight to ten days, and afterwards conditions returned to normal. In this manner Schein attempted to establish an immune belt of cattle, a result which could not be achieved by the use of serum alone. The dose of serum recommended for the buffalo is very large, viz., 50 cc. per 100 kgm. body weight, while cattle receive from 40–80 cc. according to their size and age. Schein concludes that CROVERI'S single negative experiment does not invalidate the numerous controlled positive results obtained by him in the laboratory and in the field.

[This subject appears to be of great importance, inasmuch as a safe method of conferring active immunity upon highly susceptible animals against rinderpest is a much desired object. Schein's attempts to elucidate this problem merit attention. However, it cannot be said that he has convincingly proved that safety is obtained by using a very small dose of virulent blood or that the employment of such a dose is with certainty superior to that of the bigger dose of the original method.]

RUPPERT (F). **[Precipitin Reaction in Rinderpest.]**—*Deutsche Tierärztliche Wochenschrift.* 1919. Sept. 20. [Extracted in *Clinica Vet.* 1919. Dec. 31. Vol. 42. No. 24. pp. 729–730.]

In the course of his researches upon rinderpest at the Serum Institute at Mpapua, in what was formerly German East Africa, the author frequently found great difficulty in arriving at a definite diagnosis of rinderpest; the conditions with which the disease might be easily confounded were, in particular, malignant catarrh, East Coast fever. and a form of paralysis which is common in Africa. The lesions which are usually stated to be associated with rinderpest in the stomach and intestines were absent in more than 60 per cent. of the cases examined. The author performed some tests which would appear to indicate that there is present in the serum of highly hyperimmunized animals an antibody which is capable of provoking a distinct specific precipitin reaction. When, therefore, serum from a beast which has received a few litres of blood from an animal at the height of an acute attack of rinderpest is added to a clear chloroformed extract of an animal dead of the disease, a reaction is observed in the form of an opaque zone at the meeting of the fluids even when the hyperimmunized serum is diluted 20 times. With 25 organs of rinderpest animals obtained from various sources positive results were obtained in all of them, whereas negative results were obtained in all cases with serum and normal extracts, or extracts in normal saline. Likewise negative results were obtained with extracts of organs of cattle affected with East Coast fever and redwater. In positive cases the ring at the zone of contact appeared comparatively rapidly and was apparently completely formed in a minute. Further researches on methods of sero-diagnosis were interrupted by the outbreak of war.

VALLÉE (H.) & CARRÉ. **Hémoprévention et hémovaccination antiaphteuse.**—*Rec. Méd. Vét.* 1921. July 15. Vol. 97. No. 13. pp. 369–372.

The specific properties of the blood of cattle recovered from foot-and-mouth disease have been made known for many years by the researches of LÖFFLER and FROSCH, PERRONCITO, ROUX, NOCARD, Vallée and Carré.

Confronted with the impossible task of obtaining a sufficient quantity of efficacious anti-foot-and-mouth disease sera, various authors have been naturally tempted to utilize in the struggle against this redoubtable epizootic disease the blood or the serum of animals that have recovered from an attack (PERRONCITO, KUYPERS, BEIJERS, BROERSMA, AUKEMA, LEBAILLY, DESLIENS, etc.).

While some of these authors have been entirely satisfied with the result, others have cast the gravest doubt upon them, and thus Vallée and Carré considered it necessary to collate and compare the results published in the literature and submit them also to an experimental trial. They therefore resumed their original work, prosecuted with NOCARD and ROUX in 1902, and they now state that they are in the position to formulate certain definite statements with regard to the value of immunization and the conditions in which it should be employed. These statements are summarily expressed as follows :—

1. Cattle recovered from foot-and-mouth disease do not all furnish, even when exposed to like conditions of infection, bloods which are equally active ; this fact is, of course, on analogy with what is known to occur in animals destined to produce various therapeutic sera experimentally. In order therefore to obtain uniform results in the adoption of methods of treatment involving the inoculation of blood, it is necessary to utilize to the widest extent possible a uniform mixture of citrated bloods, withdrawn from quite a number of animals, on the 12th to the 15th day after the appearance of vesicles. In no case should blood withdrawn from a single convalescent animal be utilized, no matter how severe the infection it has suffered from appeared to be. Moreover, in judging the severity of the progress of the disease in an animal, great care should be taken not to confound the effects attributable to the infection itself with those which are in the nature of various complications supervening upon the lesions from which the virus has escaped.

2. Citrated blood to which an antiseptic substance has been added may be preserved in a refrigerator at + 1° C. for at least three months without losing any of its useful qualities.

3. In no case should the dose employed be less than 1 cc. of blood per kgm. live body weight of the animal to be immunized, no matter what species it belongs to.

4. If the above conditions are complied with, the injection of citrated blood from recovered animals quite uniformly shows itself to be endowed with definite preventive qualities, which enable the inoculated animals to withstand successfully both natural infection and subcutaneous inoculation with massive doses of virus (virulent lymph, 1/20th cc. ; virulent blood, 5 or 10 cc.).

5. The duration of the immunity conferred upon the inoculated animals does not exceed a fortnight in the majority of cases. It may be prolonged corresponding lengths of time by administering a second or a third injection having regard to the same conditions as with the first injection.

6. The only animals that can be protected in this way are those which are still free from infection at the time of the injection. If the animals are inoculated during the incubation period the blood of recovered animals does not have the least effect in curtailing the progress of the disease, which, however, runs an apparently more benign course.

Although this method of blood inoculation is capable of giving such fruitful results, especially in keeping alive young subjects invariably, it is of limited value as compared with a method that would be capable of conferring upon the animals an immunity of longer duration. The experiments carried out by LÖFFLER, NOCARD, ROUX, and the authors, COSCO and AGUZZI, etc., are well known. The majority of them were attempts at sero-vaccination. In resuming their investigations, Vallée and Carré used the blood of recovered animals, associated with the virus of foot-and-mouth disease in various ways, in the form of the lymph or filtered macerated epithelium, or preserved defibrinated virulent blood.

It was found that one may inoculate with impunity cattle or sheep with doses of from 1–10 cc. of virulent blood when they are protected with the blood of recovered animals, and the virulent inoculation may be performed simultaneously or five days later than the preventive inoculation. Animals thus treated, and subsequently tested when the effects of the preventive dose of blood must have with certainty disappeared, were found to resist infection, either by contact with affected animals or by vesiculation. They were found able to emerge successfully from an outbreak, outside the laboratory, without contracting the disease.

Experiments are in progress with a view to establishing the duration of the immunity thus conferred and its value against virus obtained from animals of different breeds and used for various purposes, and also in order to find out whether it is preferable to carry out both inoculations simultaneously or successively. Vallée and Carré publish their results, which involve observations on some hundreds of animals, at this juncture in order to comply with the recommendations of the International Conference on Epizootics, which recently opened its sittings at Paris. [See preceding number of this *Bulletin*, p. 200.]

MISCELLANEOUS.

VELU. **Les anémies pernicieuses du cheval au Maroc et les diagnostics biologiques.** [The Pernicious Anaemias of the Horse in Morocco and Biological Methods of Diagnosis.]—*Rec. Méd. Vét.* 1921. June 30. Vol. 97. No. 12. pp. 263–267.*

The term " Fez disease " is applied to a group of diseased conditions affecting the horse in Morocco, all of which reveal very similar symptoms. FRAY (*Revue Vétérinaire Militaire*, 1913, pp. 479–480) gives the following as the most constant symptoms: " Sudden rise of temperature, petechiae on the conjunctiva, paralysis of the hind quarters, and sometimes a jaundiced tinge of the mucous membranes. The progress of the disease is slow, the affection being of a distinctly chronic type. The period of convalescence is long and relapses are both frequent and serious."

Clinical observations do not enable one to differentiate between the various pernicious anaemias included under the above name, for all show wasting, digestive disturbance, febrile attacks and muscular weakness; but it is now known that the term "Fez disease" comprises at least four distinct diseases:—

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* Abstracted by Mr. T. J. Bosworth, B.Sc., D.V.S.M., M.R.C.V.S.

(1) Trypanosomiasis of horses in Morocco (including dourine). (2) Piroplasmosis. (3) Spirochaetosis. (4) Filariasis.

A simple examination will, however, often lead to the identification of the causal organism. Thus, microscopical examination of a drop of fresh blood or oedematous fluid between a slide and cover-glass reveals the presence of filariae, spirochaetes or trypanosomes if made during a febrile crisis or when the parasites are present in sufficient numbers. Thin smears from the first drop of blood or serosity obtained, fixed and stained by Pappenheim's or Laveran's panchrome, will show the presence of piroplasms which appear in the rose-coloured corpuscles as dark violet masses of chromatin with a little sky-blue protoplasm, or in certain piroplasms surrounded merely by an uncoloured zone. Intraperitoneal inoculation of the dog with 100–200 cc. of citrated blood may be resorted to when trypanosomes or spirochaetes are suspected but are not present in sufficient numbers to detect under the microscope.

If the actual cause of the condition can be ascertained, then it is possible to apply rational treatment. There are, however, cases in which the etiology is obscure and further investigations are necessary. A record of systematic blood examinations in all cases would be of valuable assistance.

WRIGHT (Lewis H.). **Some Observations regarding Eosinophiles.**—*Jl. Agric. Res.* 1921. Aug. 1. Vol. 21. No. 9. pp. 677–688.

Until recently the presence of an unusually large number of eosinophiles in the blood was considered to be almost diagnostic of a severe infestation with some form of external or internal parasites, while on the other hand an absence of eosinophilia was held to present very strong evidence that the animal was almost, if not entirely, free from parasitic invasion. During the past few years, however, our knowledge regarding the relationship between parasitic infestation and an eosinophilia has been undergoing a considerable change. In this paper Wright, of the Nevada Agricultural Experiment Station, reports observations based on a study of 40 horses. From one to more than 20 blood examinations were made on the individual cases, some of which extended over a period of about 18 months. In all the cases the animals were carefully post-mortemed and a close search for internal parasites was made. None of the animals harboured external parasites. In the first table the blood-counts of 15 horses in apparent good health are given; 79 counts in all were made and the average count was as follows: haemoglobin 90·4, erythrocytes 7,783,300, leucocytes 7,693 (lymphocytes 34·8 per cent., polymorphonuclears 52·9 per cent., mononuclears 6·8 per cent., *eosinophiles 5·3 per cent.*, mast cells 6 per cent., transition cells 0).

The percentage of eosinophiles in the peripheral blood of these healthy horses varied greatly even when the examinations were made at frequent intervals (in one horse, for example, they varied from 0·2 to 11·2 per cent., and this maximum figure fell to 3·6 per cent. after an interval of 10 days). These exceedingly varying results may possibly account for the different conclusions arrived at by many writers regarding the percentages of eosinophiles in the blood of normal horses and horses suffering from various diseases.

The study of the blood in what appeared to be normal animals presents considerable difficulty, in that nearly all harbour numbers of parasites of various genera. Two of the apparently normal animals observed by Wright presented a very high percentage of eosinophiles. One animal which was examined nine times over a period of six months gave an average of 17·2 per cent. of eosinophiles; and on post-mortem examination this animal showed a relatively small number of internal parasites. Another horse examined once showed 13 per cent., and on post-mortem there were found large numbers of internal parasites. These were the only two animals that showed an unusually large number of eosinophiles. At single examinations of some of the other horses, results exceeding this 13 per cent. figure were obtained.

In the second table figures are given concerning the blood-counts of eight horses in poor condition due to internal parasites. Nineteen counts were made, the average results were: haemoglobin 69·2 per cent., erythrocytes 5,822,000, leucocytes 8,363 (lymphocytes 33·1 per cent., polymorphonuclears 53·6 per cent., mononuclears 11·4 per cent., *eosinophiles 2·2 per cent.*, mast cells 0·08 per cent., transition cells 0).

In none of these cases is there a higher figure than 5·8 per cent. eosinophiles recorded. The post-mortem examinations revealed in nearly all a severe parasitic infestation. It would thus appear that the degree of eosinophilia gives no indication as to the intensity of the parasitism in horses.

WEINBERG and SEQUIN (1914–15), however, have studied this question very fully and shown that the eosinophiles are specifically attracted towards certain toxic substances, especially those of parasitic origin. It may be, therefore, that the degree of eosinophilia is related somehow with the resisting power of the animal. If this is high the eosinophiles would be plentiful in the infested animals, while, on the other hand, if the resistance were low the eosinophiles would be few. In general it would seem that the physiological functions of the leucocytes are essentially the same in the various species of animals. If this be so, cattle must be ordinarily very severely infested with parasites, or else their resistance is high, for as has been shown by DIMMOCK and THOMPSON (1906) the average percentage of eosinophiles in the blood of normal cattle is 13·15. According to BURNETT's tables the percentages of eosinophiles are about the same for all animals except cattle.

Hitherto the eosinophile content of the horse's blood has been used as a valuable aid in differentiating between infectious anaemia and anaemia due to parasitic invasion. The symptoms of the two diseases are very similar, but the absence of an eosinophilia and the presence of a recurrent high temperature have been taken to indicate infectious anaemia. In the horses used by Wright in the above estimations, however, transmission experiments failed, and therefore infectious anaemia could be definitely excluded. Again, in a few months all the horses which were assumed to be in poor condition due to internal parasites died or were killed; seven were severely infested with Strongylus and Cylicostomum, and the eighth harboured an enormous number of bots. Moreover, when they were first examined the horses were in fair physical condition, and some, in fact, were in good condition. Their resistance, therefore, should have been good. The degree of eosinophilia did not, however, appear to bear any regular relationship with the progress of the affection although in most it appeared to decrease considerably.

In the third table the blood-counts of two horses, one that apparently died from infectious anaemia and another suffering acutely with septicaemia, are given. The average count was: haemoglobin 85 per cent., erythrocytes 7,325,400, leucocytes 6,693 (lymphocytes 33·2 per cent., polymorphonuclears 58·6 per cent., mononuclears 6·3 per cent., *eosinophiles 2 per cent.*, mast cells 0·02 per cent., transition cells 0). A moderate degree of parasitic invasion was found post-mortem in both these animals.

A series of counts are next given of horses suffering from acute, subacute, and chronic infectious anaemia. In the acute cases the figures were as follows:—8 horses, 19 counts, haemoglobin 73·6 per cent., erythrocytes 6,285,600, leucocytes 7,021 (lymphocytes 29·3 per cent., polymorphonuclears 58·1 per cent., mononuclears 5·4 per cent., *eosinophiles 2·5 per cent.*, mast cells 0·04 per cent., transition cells 3·3 per cent.).

It is to be noted, however, that transition cells were only detected in one horse which at two counts had given remarkably high percentages of 31·4 and 30 per cent. This was a four-year-old mare which on post-mortem revealed a few bots, one Setaria, and a small worm-free aneurism of the anterior mesentery artery, and an enormous infestation of the caecum and colon with Strongylus and Cylicostomum.

Nearly all these horses revealed a moderate or severe parasitic invasion post-mortem.

In the subacute cases (2 horses, 4 counts) the figures were: haemoglobin 73·8 per cent., erythrocytes 5,655,000, leucocytes 6,754 (lymphocytes 37·8 per cent., polymorphonuclears 54·9 per cent., mononuclears 6 per cent., *eosinophiles 1·2 per cent.*, mast cells 0·15 per cent., transition cells 0). One of these horses was moderately infested and the other seriously infested with worms.

In the chronic cases the figures were as follows:—7 horses, 53 counts, haemoglobin 84 per cent., erythrocytes 7,119,000, leucocytes 7,325 (lymphocytes 33·5 per cent., polymorphonuclears 56 per cent., mononuclears 7·3 per cent., *eosinophiles 2·9 per cent.*, mast cells 0·3 per cent., transition cells 0). These animals were all found to be infested with worms post-mortem, and the degree of invasion varied from slight to severe.

HADWEN (1918–20) (see this *Bulletin*, 1920, Vol. 8, p. 144) has maintained that the eosinophiles in infectious anaemia are diminished in number and sometimes absent from the peripheral blood. This disappearance of the eosinophiles was also noticed particularly in some of Wright's acute cases and in a few of the counts made from the chronic cases.

[It seems probable that Wright was also working in a district ordinarily heavily infested with worm parasites, so that the degree of infestation in his apparently normal horses is very likely unusually high.]

REPORTS.

BRITISH GUIANA. **Report of the Department of Science and Agriculture for the Year 1918.** [HARRISON (J. B.), Director.] Live Stock, p. 30; and Report of Government Veterinary Surgeon [MILNE (A. Seton)]. Appendix IV, pp. 63–64.—141 pp. F'cap. 1920. Georgetown, Demerara: "The Argosy" Co., Ltd., Government Printers.

The Agricultural Section gives the following figures for the year 1918:—Horses 1,602, mules 2,359, donkeys 5,332, cattle 107,108, buffaloes 176, goats 11,236, sheep 20,611, swine 12,582. There was a general decrease in the numbers of all kinds of stock except swine, which showed increase. There was a marked decrease in the number of milch cattle available for the milk supplies of Georgetown, of New Amsterdam, and of the principal villages. This was partly due to the fact that many East Indians who formerly made their living, or obtained assistance in doing so, by keeping cattle in the production of milk for sale now give their attention to rice planting, and also partly to the change of policy adopted by most proprietors of sugar estates, who now refuse to allow their managers to keep large herds of cattle. This restriction, although it may be in the interests of the estate proprietors, has taken away the incentive towards the improvement of live stock in the colony and done away with what were regarded as excellent object lessons to small farmers and cattle keepers in the economic maintenance of live stock. It is regretted that in the interests of the colony large proprietors of sugar estates do not themselves carry on a live stock industry as a subsidiary undertaking to their main one.

The Government Veterinary Surgeon reports that the colony is at present entirely free from epizootics. No case of glanders had been reported for two or three years, and it was anticipated that the colony would be before long free from anthrax and swine-fever. The live-stock at the Botanic Gardens appear to be in very good health and the importation of some good working stock is contemplated. Some pig, horse, and donkey breeding operations were carried on, and Government stock and police horses were also looked after.

MAURITIUS. **Annual Report of the Department of Agriculture for the Year 1920.** [TEMPANY (H. A.), Director of Agriculture.] Veterinary Division; Report of the Government Veterinary Surgeon. p. 11.—19 pp. F'cap. 1921. Port Louis: Acting Government Printer.

This report contains nothing of great interest. During 1920, 15,541 animals were imported, to the value of over one million rupees. These included Madagascar bullocks 9,931, goats 2,389, pigs 1,310, sheep 1,169, mules 258, horses 169, ponies 218, donkeys 4, dogs 6, cows and bulls (stud animals) 81, miscellaneous 10.

A number of dogs were examined on board different ships, but no landing was allowed, as the animals were not accompanied with the necessary certificates. A number of animals belonging to different Departments were attended to during the year. One herd of cattle which had been affected with surra was tested with negative results and released from quarantine. Three cases of this disease were detected, in two horses and one mule, and the affected animals were slaughtered. No cases of epizootic lymphangitis or piroplasmosis occurred during the year. Animals on several estates were tested with tuberculin, these comprised 158 cows, heifers, and bulls; 20 reacted to the test and were slaughtered. Twenty-three cows and bulls imported from Australia were tested on landing, as they were not accompanied with certificate relating to freedom from the disease. One cow reacted and disclosed lesions post-mortem. Cases of illegal slaughtering of immature animals occurred and the owners were prosecuted, but 44 cattle under age were allowed to be slaughtered as they were sterile, affected with incurable diseases, or accidentally injured.

A number of interesting breeding experiments were carried out on the Stock Farm with Jersey, Normandy, and Holstein-Afrikander and Indian cattle.

EGYPT. **Ministry of Agriculture. Veterinary Service. Annual Report for the Year 1919–20.** [LITTLEWOOD (W. L.), Director.]—47 pp. 1921. Cairo: Government Press. [Price PT. 5.]

SECTION ON CONTAGIOUS DISEASES.

Cattle Plague (*Rinderpest*). During the year, 1,794 deaths were reported in two Governates and 14 Provinces. This represented a death-rate of about 0·1 per cent. In addition to the cases that occurred in the interior of the country, 621 cases were detected amongst cattle imported from the Sudan. The number of cattle (actively) immunized during the year was 46,110, with 171 deaths following upon the "double" inoculation. Of this number 4,964 cattle were inoculated against payment at the request of the owners. Several tests were made with virulent blood upon the cattle of the State domains which had been immunized, and results were found to be excellent. In one experiment the immunity was found to have lasted for six years and four months.

Arrangements were made to reopen the Serum Institute at Abbasiya from April 1st, 1919, for the manufacture of anti-rinderpest serum. On account of difficulties in obtaining the necessary equipment and in erecting and repairing the buildings required, the Institute could not be placed in working order until the end of August, 1919. In June, 1919, owing to the insufficient supply of Indian serum, 20,000 doses (50 cc.) were ordered from the Serum Institute at Nairobi, British East Africa. This serum was tested at the Serum Institute and it was found to be weaker than the Egyptian serum. It was hence found necessary to increase the dose by 50 per cent. In order to meet the Egyptian requirements it was found necessary to keep 150 serum-producing bulls at the Institute, and the output of serum is still regarded as inadequate, and it is therefore necessary to increase the number up to 200 bulls. The Budget for the Institute for the Financial Year was estimated at £E.27,450.

An account is given of the equipment and administration of the Institute. The daily ration for the serum bulls is: beans, crushed, 1 kgm.; maize, crushed, 1 kgm.; linseed cake 2 kgm.; *tibn* 6 kilos; *drees* 2 kgm. *Drees* is substituted by *bersim* and green *dura* when possible, the ration being 1 kgm. of *drees* to 7½ kgm. of green fodder. Rock salt is always supplied. The best type of Egyptian bulls is purchased whenever possible (average price £E.45), and 189 bulls have been purchased, together with 13 Cyprus bullocks, which have been hyperimmunized.

Out of the total number, 202, there remained 158 on March 31st. This shows a total loss of 44 animals (21·7 per cent.). These heavy losses were unavoidable, inasmuch as the animals had to be bought and hyperimmunized very quickly. The losses were: deaths 32, bled to death for serum 8, stolen 4. The causes of death were as follows: anaphylaxis (or purpuric condition following re-enforcing) 14, Texas fever 8, toxaemia 4, gastro-enteritis 2, cattle plague 1, heart failure 1, ruptured aorta 1. Animals bled to death for serum suffered from chronic debility following Texas fever 3, chronic lameness 2, tuberculosis 2, tuberculosis and cysticercosis 1. Anaphylaxis, which caused great losses in the previously established Serum Institute, gave rise to nearly half the deaths recorded.

Forty-five cases of Texas fever were diagnosed in the serum cattle or in those which are still being immunized. Of the 8 fatal cases 2 occurred in bulls which had been doubly inoculated and which had never been re-enforced, while 1 of the remaining 6 was in a serum-producing Cyprus ox. Arrhenal is stated to have been largely used in the treatment of the disease and to have given good results. Only one Egyptian animal died after the first double inoculation, and this animal had been inoculated with British East African serum, dose 100 cc. Eight hundred and forty-eight separate re-enforcements were carried out, four litres of virulent cattle plague blood being given at each injection. One thousand six hundred and thirty-two bleedings were performed, giving a total of 6,712 litres of blood.

As in previous years, Cyprus cattle were imported for the production of virulent blood (294 were imported). They were generally of good quality, but there was some difficulty in obtaining regular supplies. A total of 34 cases of Texas fever was diagnosed in these Cyprus cattle, and 60 cases of Egyptian fever. The greatest care was taken to ensure that virulent blood issued to the Provinces was free from Texas fever. The Cyprus cattle were inoculated with about 2 cc. of virulent blood, as required, and bled to death from the carotid artery on the sixth day after inoculation. The blood was examined microscopically on the fourth, fifth and sixth days after inoculation, and no blood showing redwater piroplasms was issued. The percentage yield of serum, after centrifugation and addition of preservative, varied from 47·6 in October, which was very hot, to 36·8 per cent. in the cold month of February. The serum bottles utilized were of about 220 cc. capacity. The minimum safe dose of serum for Cyprus cattle was found on testing to be 20 cc. per 100 kgm. body weight, but in one case 15 cc. saved the cattle in the test. Taking the susceptibility of Egyptian cattle as half that of the Cyprus cattle, the safe dose for large Egyptian cattle averaging about 500 kgm. weight was fixed at 100 cc. per head. A test was also carried out on three Cyprus cattle with serum taken from a lot of six bulls which had only been re-enforced twice and were bled about six weeks after the last re-enforcement. The test showed that although the serum was efficient it was not strong enough to use alone in the same dose as the mixed serum.

Rabies.—During the year, 64 cases were reported in three Governates and 13 Provinces amongst animals (59 dogs, 3 calves, and 2 wolves). Nearly 2,950 dogs were seized in Cairo during the year, and, in addition, 3,386 dogs and 5,815 cats were destroyed in Cairo and its suburbs. In all outbreaks of rabies, and in every suspicious case, a certain number of dogs in the village were destroyed in order to prevent the disease extending. Hence in the Mudiriyas and Governates (excluding Cairo and Alexandria), 43,352 dogs and cats were poisoned.

Glanders.—One hundred and six cases of glanders were detected in three Governates and five Provinces, and 4,284 animals were tested with mallein.

Epizootic Lymphangitis.—Seven cases were reported, viz., six in the Cairo Governate and one in the Sharqiya Province. Treatment with novarsenobenzol gave satisfactory results.

Anthrax.—Nine cases reported.

Sheep-pox. Number of cases reported 334, chiefly in quarantine stations among imported Sudanese sheep.

Foot-and-mouth Disease.—Forty cases reported.

Haemorrhagic Septicaemia.—One hundred and thirty-five cases in cattle and buffaloes reported. Preventive treatment by serum inoculation was adopted in several outbreaks. The animals thus treated with satisfactory results numbered 4,222. In addition, 13 cases were detected in equines.

Mange.—Cases reported numbered 167, in two Governates and five Provinces. The number of camels treated for mange against payment during the year was 1,340.

Strangles.—Sixty cases reported during the year, in one Governate and six Provinces.

Spirochaetosis in Fowls.—No cases reported.

Trypanosomiasis.—One case only was reported, in a camel in Beheira Province associated with filariasis.

Piroplasmosis in Egyptian Animals.—One hundred and seventy-seven cases were detected in cattle, in one Governate and 12 Provinces. including 28 animals imported from Cyprus. Of these, 57 died or were slaughtered and 120 recovered. Arrhenal is said to have given satisfactory results in treatment and the use of this product is contemplated on a larger scale. The number of animals sprayed for the destruction of ticks against payment was 838.

Piroplasmosis in Soudanese Animals.—Thirty-five cases were reported in cattle and sheep in the quarantine pens. All died or were slaughtered.

Tuberculosis.—Cases reported numbered 3,108, the great majority of these being in the Cairo and Alexandria abattoirs.

Tetanus.—Twenty cases were reported in three Governates and 10 Provinces.

Coccidiosis.—Fifty-four cases were detected, viz., 53 in Sudanese sheep in the Shellal and Cairo quarantine pens and one in a bull.

Contagious Bovine Pleuro-pneumonia.—Forty-four cases were detected, all in animals imported from the Sudan.

Stiff Sickness.—Cases reported numbered 346, in one Governate and 11 Provinces.

Bursati.—Three cases were reported, viz., two in horses and one in a donkey.

Cowpox.—One case only was detected in a buffalo.

Camel-pox.—One case was detected.

Horse-pox.—One case was detected in a mule.

Fowl Plague.—Cases reported numbered 156 in one Governate and three Provinces.

Fowl Cholera.—Two cases were reported.

Actinomycosis.—One case only was detected.

Malta Fever.—One case was detected in a goat.

Swine Plague.—Thirty-five cases were reported, mostly in the Canal Governate.

Swine Fever.—Three cases were detected in the Cairo quarantine pens.

Malignant Oedema.—Seven cases were reported in two Provinces.

There passed through the Shellal quarantine station, 25,900 cattle, 143,830 sheep, 55 horses, mules and donkeys, 207 camels, 137,543 hides and 124,839 skins, and, in addition, there were imported from the Sudan, via Suez, 2,555 cattle, 9,111 sheep and goats, 30 horses, donkeys and mules, 241 hides and 410 skins.

Besides these animals imported from the Sudan, there were imported into Egypt during the year 457 cattle and buffaloes, 355 horses, mules and donkeys, 27,998 sheep and goats, 3,570 pigs, etc., and 11,426 camels.

Figures are given concerning the Isolation Hospital for Contagious Diseases of Animals at Abbasiya. In 1919 there were 505,150 cattle and 539,741 buffaloes in the country. This shows a decrease of 11,610 cattle and 31,365 buffaloes as compared with 1918. A census also showed 31,192 horses, 21,890 mules, 576,141 donkeys, 117,678 camels, 21,331 pigs, 858,107 sheep, and 325,854 goats.

The slaughterhouse returns for the year are also given.

No frozen meat was imported by the two British firms during the year, as all Australian frozen meat was purchased by the British Government, as in the previous year.

Figures are given concerning the veterinary legal cases undertaken.

VETERINARY PATHOLOGICAL LABORATORY. [MASON (F. E.) Veterinary Pathologist.]

A total of 1,675 specimens was examined at the laboratory, a number of which appeared to have been of considerable interest. A rough summary is also given of a series of investigations that were carried out. It is stated that bursati, which is regarded as a disease of equines caused by a specific fungus, is not simply a skin affection, as hitherto described by all writers, but that characteristic lung lesions caused by the same fungus are constant. The conclusion arrived at is that infection takes place primarily in the lungs, probably by the inhalation of spores and that the skin lesions develop when the external atmospheric conditions are suitable for the growth of the organism on the surface of the body. This is held to account for the seasonal recurrence of the skin lesions year after year in the same subject. Incidentally it was discovered that "summer sore" (*Dermatitis verminosa*), which is considered to be a skin disease of equines caused by filarial embryos (*Filaria irritans*), also exists in Egypt. The condition is said to resemble the skin lesions of bursati so closely that differential diagnosis is uncertain without recourse to microscopic examination.

Experiments on cattle plague were continued, but are not yet completed. Immunity tests were continued on cattle that had been protected against cattle plague by the so-called "double" inoculation. Fifteen bulls that had been immunized six years and four months previously proved resistant to inoculation with 5 cc. of virulent blood and showed no evidence of reaction.

Experiments were continued upon the curative treatment of epizootic lymphangitis by means of novarsenobenzol. The results are stated to confirm those of previous experiments. Good results are claimed to have been obtained provided the subjects were not advanced in age. A new hydatid was discovered in the camel and named *Cysticercus cameli*.

SCHOOL OF VETERINARY MEDICINE. [MASON (H.), Director.] Owing to the transfer of the School at Giza and to the establishment of a proper infirmary in the vicinity of the School premises, greater facilities were obtained for the practical teaching of students. The former Director, RABAGLIATA (D. S.) was transferred as Director of the Serum Institute. In April, 1919, there were 27 students in the School (1st year 10, 2nd year 7, 3rd year 8, 4th year 2). The number of students is regarded as unsatisfactory, and their attendance appears to have been irregular. The unsatisfactory number is due to the fact that although the standard of the entering certificate was raised to the Secondary instead of the Primary Certificate since 1914, and the School placed on the same footing as other high schools, the recognition of the School as a high one has not yet been finally decided upon.

MOROCCO. **Rapport du Vétérinaire Major de 2ème Classe Velu sur le Fonctionnement du Laboratoire de Recherches pendant l'année 1920.** MS. received 27th April 1921. 11 pp. F'cap. With 3 circulars attached.

In this report Velu gives a brief account of the organization of his laboratory at Casablanca, and the methods which he has instituted in order to control and obtain further knowledge on the subject of contagious disease of stock in Morocco. During the course of the last few years this author has contributed a considerable number of valuable articles on tropical diseases to the literature, in spite of the fact that his laboratory facilities appear to have been strictly limited. In 1920 the research laboratory was, however, reorganized so as to permit of an increase in its activity, and it is hoped that when the plans outlined in 1914 for the reconstruction of the Experiment Station will have been completed, the service, of which the author is the Director, will be capable of rendering great assistance to the stock-breeding industry of the country. Hitherto the laboratory has directed its activity to the following purposes:—

1. Laboratory diagnosis of material received. In this connection an attached circular addressed to veterinary inspectors states precisely the manner in which virulent material destined for the laboratory is to be collected and transported, and in a table is shown the diseases or disease symptoms in connection with which the laboratory should be consulted, the samples to be made and forwarded, what the laboratory is capable of doing therewith, and the information it can supply thereon.

2. The distribution of sera and vaccines and, in particular, those used in connection with vaccination against anthrax, blackquarter, and sheep-pox, details concerning which are given in two of the attached circulars.

3. Application of modern recognized methods to the study of the principal problems concerning animal disease in Morocco, viz., investigation regarding the causes of the most widespread diseases of the country, conditions which favour their appearance, and the measures for dealing with them. Special reports have been published from time to time in this connection.

The technical personnel of the laboratory is considered to be sufficient, and comprises two veterinary and two laboratory assistants, together with four natives. The present laboratory is quite inadequate, and, in the circumstances, it would be absolutely impossible to combat a disease such as rinderpest if it were imported into Morocco. Moreover, small laboratory animals cannot be bred on account of the impossibility of disinfection. Pigeons die of fowl cholera, guinea-pigs of a plague, rabbits of coccidiosis, mange, etc.

In order to assist stockowners by means of laboratory diagnosis, the necessary material for obtaining samples, together with instructions are now distributed to all officers in the public service, and to the chief breeders, so that in the event of an outbreak the essential condition of having material forwarded immediately for diagnosis may be complied with.

With regard to the distribution of sera and vaccine, which rose to well over 100,000 doses in 1920, a few complaints were received from some owners with regard to the quality of the products, but most of these were found to be groundless. There was one important exception, however, namely, with regard to the transient effects of vaccination against anthrax and the inefficacy of serum against the disease.

The exportation of sheep from Morocco has hitherto been greatly restricted owing to the numerous difficulties encountered by sheep owners, and, in particular, they have been compelled to keep their animals for a month after sale in order to have them vaccinated against sheep-pox. The hiring of grazing ground during this period is often very costly, and in the meantime the sheep lose condition considerably, and it is often very difficult to arrange subsequently for their transportation by sea. Velu asserts that in order to overcome this difficulty completely sheep-pox vaccination should be carried out at the owner's place, for they can then be exported to France, where they would always obtain a very ready market if they have been treated previously within a year. The best time for vaccinating is during the winter, and the material can be obtained for a very small sum from the laboratory (0.28 fr. per dose, official mark 0.12 fr., and veterinary fee 0.20 fr. per head).

With regard to investigation work, the following were the principal subjects that received notice :—

The Trypanosomiasis of Horses in Morocco.—Researches have been carried out on this subject since 1914, and studies in connection with the identification of the trypanosome have been resumed in collaboration with BOUIN. A number of the author's studies on the trypanosome (which he calls *T. marocanum*) have been summarized in this *Bulletin.* Attempts at treatment with an arsenical drug called "osarsan" have been encouraging, and appear to be on the point of furnishing useful results.

Dourine.—The treatment of this trypanosomiasis is likewise under control, and it has been found in this affection again that the drug treatment requires, in order to be effective, the employment of at least two trypanocidal products.

Infectious Anaemia of the Horse.—The so-called "Fez" disease (*Maladie de Fez*) has been still further dismembered, for it is now found to comprise, besides trypanosomiasis, spirillosis, piroplasmosis, and microfilariasis—still another infection manifested by the same clinical syndrome. This newly-discovered condition is said to be an infectious anaemia which is generally curable. Researches are being undertaken upon it in conjunction with BIGOT and BALOZET.

Anthrax.—The author's experiments have resulted in a simplified method of vaccination, and it was found that in Morocco immunization might be commenced with the injection of the 2nd Pasteur vaccine. In the circular it is, moreover, stated that on account of the high degree of virulence attained by this disease in Morocco it is absolutely necessary to vaccinate herds against it twice annually, first with the 2nd Pasteur vaccine, and then secondly, 12 days afterwards, with a special strong vaccine prepared by the Casablanca Laboratory. In the affected districts, especially Gharb, Chaouïa and Mzab, deaths occur in all herds with the advent of the hot season, and then take place continuously in the form of an irregularly progressive epizootic. In these circumstances sero-vaccination is indicated, but is laborious and rather costly. However, it is recommended that in all infected districts, that is to say, districts in which the disease has appeared during preceding years, preventive vaccination should be undertaken as a routine measure, and the time when it is best carried out is from the commencement of the rains up to the end of March. It would appear, moreover, from tests made in Morocco, that the serum is wholly inefficacious. [For further details see this *Bulletin*, 1920, Vol. 8. p. 141.]

Pneumo-enteritis of the Pig.—Studies in connection with pig diseases of this type have been continued [see this *Bulletin*, 1920, Vol. 6, p. 126]. Anti-fowl cholera serum would appear to have given good results in an outbreak of Pasteurellosis among pigs [see this *Bulletin*, 1920, Vol. 8, p. 322].

Fowl Cholera.—Experience gathered in a number of outbreaks in this disease would appear to indicate that it is possible to combat the disease by means of serum alone without resorting to vaccination. Serum was prepared in the laboratory, and by its means it was possible to cut short a number of severe outbreaks. Special attention, it would seem, has to be directed towards the manufacture of the serum.

Foot-and-Mouth Disease.—The principal lesions, and the value of cardiac tonics in treatment, were studied in the course of an outbreak [see this *Bulletin*, 1921, Vol. 9, p. 113].

Cerebro-spinal Meningitis.—Two cases of this condition in goats were studied. Attempts at serum treatment were ineffective.

Parasites and Parasitic Infections.—Numerous observations were made in this connection, and the use of arsenical baths in the treatment of mange was specially studied.

Several cases of echinococcus infestation of the heart were observed [see *supra* p. 232].

Miscellaneous Studies.—These were made in connection with (1) pyo-bacillosis of the pig, its etiology, characters of the causal agent, and treatment by means of pyo-therapy; (2) pseudo-tuberculosis of the pig, and the method of carrying out the intrapalpebral test in this animal; (3) the feeding value of fish meal, and (4) the surgical treatment of inguinal hernia in young pigs.

Instruction courses were also given to veterinary surgeons recently arrived in Morocco.

NIGERIA, Northern Provinces. **Annual Report of the Veterinary Department for the Year 1920.** [BRANDT (F. R.), Chief Veterinary Officer.]—11 pp. F'cap. Lagos: Government Printer.

The staff, comprising altogether three veterinary officers, appeared to have been engaged chiefly in tours of inspection and instruction of native stock inspectors and advising owners and native officials.

Northern Zaria, part of Southern Kano and Sokoto were the only Provinces which could be attended to during the year by veterinary officers. As a result of these tours, numerous outbreaks of disease were detected which had not been reported. The Fulani cattle owners are now not so apprehensive towards veterinary officers as they were a few years ago, and with the increase of veterinary staff it is hoped that the Department will shortly be in a position to acquire detailed knowledge of existing disease and combat outbreaks by inoculation measures, provided the native administration can exert an efficient control on diseased herds. There are now 44 native stock inspectors who have received an elementary training on live stock and contagious diseases, and appear to be of some use when working under the supervision of a veterinary officer.

A meeting of Headmen of all the Zaria districts was called for the first time in 1920, and 88 outbreaks of disease in this Province were subsequently notified. The natives exhibit extraordinary reticence with regard to the incidence of disease in their herds, and disease thus spreads to a considerable extent among cattle, especially as the result of trading. The regulations in connection with the control of disease, such as reporting, quarantine, and restriction of movement, are supposed to be enforced by the native administration, but the difficulties in carrying out these regulations are very great, and some years will elapse before they can be enforced generally. However, unless some steps are taken to initiate them, technical measures such as inoculation will be largely useless. Leaflets concerning animal disease are now printed in the Hausa language and circulated.

A scheme was submitted in February for the organization of a veterinary department sufficient to deal with the live stock problems of Nigeria. This scheme comprised administration and field staff, laboratory, experimental stock farm, and education of natives. The project was apparently approved by the Governor-General, but it was considered that the organization should be built up gradually and a commencement made on a small scale, especially with regard to the field staff. The live stock of Northern Nigeria numbers about 2½ million cattle, over two million sheep, nearly four million goats, over 130,000 horses, and over 250,000 donkeys, the total value of which is at least £20,000,000. The great problems connected with this valuable asset will only be solved by an adequate veterinary organization, and what is regarded as the keynote to the control and eradication of disease, viz., an effective police organization for enforcing measures of segregation by the native administration. The improvement and control of disease in cattle of the Northern Provinces, consisting for the most part of herds owned by nomads or semi-nomads accustomed for generations to wander uncontrolled throughout the country, and so suspicious and conservative as to avoid, whenever possible, any dealings with Europeans in connection with their animals, will obviously be a very gradual process. During the year a memorandum was received from the Secretary of State for the Colonies to the effect that the Veterinary

Department, which had hitherto been regarded as a branch of the Agricultural Department, should be a separate and distinct department.

In the Northern Provinces the connection between agriculture and live stock is very slight, for, as previously stated, by far the greater number of the cattle are wandering for most of the year. In some hamlets a few head of cattle are kept continuously, chiefly for purposes of providing milk and manure, but generally cattle are absent from the farms and villages for the whole of the year, except for a short period after the crops are gathered, when they are kept on the stubble for manure purposes. An endeavour should be made to induce the farmer to own and keep a few head of cattle on or near his farm, but the average Hausa farmer takes little or no interest in cattle and considers them to be the concern of the Fulani so much that he pays the latter to run his cattle on his farm for manure. As the Veterinary Department has a good opportunity of gaining a knowledge of live stock therefore it is proposed to establish experimental farms for the improvement of live stock.

Cattle Breeding.—The Fulani cattle owners have from time immemorial followed primitive methods, but there is no doubt that with regard to the herding and handling of cattle they are exceedingly capable. No particular attention, however, is paid with regard to the selection of bulls for breeding purposes and the strongest usually sire most of the calves. Improvements are badly needed, as evidenced by the low birth-rate and the large number which die young. The milk yield is exceedingly low and no provision is made for the conservation of fodder for young stock. Owing to the nomadic habits of the Fulani forage conservation is impracticable, but cultivation of fodder crops and conservation of grass should be adopted in the case of the comparatively few herds owned by the farmers. An experimental stock farm will prove of great value for discovering the peculiar characteristics of Nigerian live stock.

Diseases of Cattle.—Rinderpest.—For the first few months of the year the epizootic which commenced in 1919 continued, especially in Sokoto and Kontagora Provinces, and with the return of the nomad cattle from their dry season grazing grounds in Southern Zaria and Nassarawa some of the herds in the Bauchi Province, which had escaped the disease through the segregation of healthy herds in 1919, became affected. During the latter part of the year the disease began to assume an enzootic form with varying mortality. The history of the disease in Nigeria since 1914 is that after the severe epizootic of that year it existed in an enzootic form for about five years, that is to say, until the majority of the cattle, viz., those born during this period of five years, again became susceptible, when another epizootic occurred. There are therefore at present (*a*) some herds in which the disease has died out, and in which the number of susceptible animals will increase yearly, and (*b*) some herds in which it smoulders on and which remain enzootic foci. It may be argued that after a few years, when there is a large proportion of susceptible cattle, the likelihood that an epizootic will then occur will be quite as great owing to the persistence of these enzootic foci. It is, however, probable that a strain of increased virulence has been introduced from outside the Protectorate towards the north or north-east of Bornu Province, since this is the direction from which epizootics have spread. Calves under six months old, which after inoculation with virulent blood and anti-serum had shown a reaction, were observed at later periods of life to contract a natural attack of rinderpest. Brandt, therefore, considers it not unlikely that a certain degree of resistance to the disease exists in calves born of immune cows immediately after an outbreak, and that at later periods in their lives this resistance is lost (this *Bulletin*, Croveri, 1919, Vol. 7, p. 95). The general employment of inoculation measures is not recommended until thorough tests have been made as to its efficacy, for unless the nomadic stock-owners are convinced that its first general employment is successful they will do all they can to avoid it. Again, unless diseased and suspected herds can be effectually segregated inoculation with serum alone will result in an enormous wastage of serum. The conferment of active immunity entails a risk of introducing trypanosomes and probably other organisms in the virulent blood unless tested laboratory animals are available.

Contagious Bovine Pleuro-pneumonia.—As in 1919 numerous cases were discovered and the disease appears to be very prevalent. The apparently recovered animal is the chief means of spreading the disease, as these animals are sold by the owners and taken to healthy herds. It is extremely difficult to learn of this disease in a herd until infection has spread considerably. The natives have a method of inoculation which has been practised for generations, and although many deaths arise from the inoculation itself the practice should not be discouraged until inoculation with aseptic material under moderately aseptic conditions can be carried out. The general rule is to segregate herds for a period of six months, but in some cases this is found to be impracticable on account of the shortage of feeding and water, and it is left to the discretion of the veterinary officer in charge to release the herd provided the owners agree to have all suspected animals slaughtered.

Trypanosomiasis.—At the meeting of District Headmen referred to above the necessity was explained of reporting not only the diseases regarded as serious by the natives, for it is seldom that natives consider a disease to be serious unless it takes the form of a raging plague, but of all diseases. Numerous outbreaks of diseases known by various native names were found on investigation to be trypanosomiasis, due to *T. congolense* or *T. vivax* types. The herds affected had for the most part returned from their dry season grazing grounds in Southern Zaria and Nassarawa Provinces, in which parts they probably contracted the disease, but in many instances the disease appeared in local herds. During the rainy season the tsetse fly undoubtedly spreads northwards along the water courses, and sleeping sickness is said to be prevalent in the human subject on the River Gulma, north-east of Zaria. Biting flies, such as Stomoxys, Haematopota, and Tabanidae, which are very numerous in Zaria Province, act as mechanical carriers of the disease. With the opening up of trade and the employment of pack animals, it is not unlikely that trypanosomiasis will increase. Up to the present the known percentage of deaths is not high, but the available statistics from Zaria, part of Bauchi and a small part of Southern Kano comprise only a small proportion of outbreaks and mortality, and therefore even in Northern Nigeria trypanosomiasis is accountable for a very appreciable economic loss.

Foot-and-Mouth Disease.—Outbreaks were reported, but as the disease resulted in a low death-rate it was probably only very occasionally reported.

Haemorrhagic Septicaemia (in Cattle).—Outbreaks were discovered in Sokoto and Kano.

Contagious Impetigo.—This skin affection has for years been prevalent among cattle in Northern Nigeria. Although it is not frequently fatal it causes a great loss of condition. Microscopic examination reveals the presence of an organism similar to that described as causing the disease known under this name in Rhodesia (HORNBY, this *Bulletin,* 1920, Vol. 8, p. 232).

Anthrax.—Reports of suspected anthrax were received from outlying parts of the Protectorate, but in all cases in which blood smears were received no organism resembling the anthrax bacillus could be demonstrated microscopically. The Government of the United States of America now require with every imported cargo of hides a certificate that anthrax is not prevalent in the countries from which the hides originated. Such a certificate would imply that an effective veterinary organization exists in the country from which the hides were exported and also that the hides originated in the country from which they were shipped. So far as present knowledge regarding disease in Nigeria and adjoining French territory is concerned, such a certificate cannot be confidently granted. The United States of America, however, do allow hides to be imported without a certificate, provided they are, on arrival in America, submitted to some process.

Other Diseases.—Information was received of the existence of several diseases under native names. While no definite cases of tick-borne disease came to notice, it is not unlikely that in most parts of Africa diseases of this character are prevalent, but that on account of the immunity acquired during attack as young calves they are practically unrecognized.

Diseases of Horses.—Several cases of trypanosomiasis occurred, some of which yielded to arsenical treatment or recovered naturally. However, there was no opportunity to carry out reliable experiments.

Epizootic lymphangitis is a very common disease, especially in horses owned by natives, and in some cases it results in spontaneous recovery.

No serious outbreak of disease among sheep came to the notice of the Veterinary Department.

According to the Statistical Returns the numbers of cattle in Northern Nigeria appear to have decreased very considerably during the last two years, the figures being for 1918—3,533,473, 1919—2,945,290, 1920—2,394,888. Apart from the loss of cattle by disease, there is an increasing exodus of cattle to Southern Rhodesia for slaughter purposes. This is regarded as a normal and healthy sign of trade which should be encouraged provided it applies to adult cattle only. Again pleuro-pneumonia and trypanosomiasis took a considerable annual toll. However, the rinderpest epizootic, which was introduced early in 1919, was the chief factor in this very great economic loss, since, in addition to causing deaths, it had an adverse effect on the birth-rate. The significant decrease in the numbers of cattle points to the urgent necessity of an adequate veterinary department and machinery for effecting control of diseased herds.

SOUTHERN RHODESIA. **Report of the Chief Veterinary Surgeon** [SINCLAIR (J. M.)] **for the Year 1920, with the Report of the Veterinary Bacteriologist** [BEVAN (Ll. E. W.)]. 18 pp. F'cap. 1921. Salisbury, Rhodesia: Government Printer.

East Coast Fever (African Coast Fever).—Fourteen new centres of infection are reported. In reality, however, there were only three fresh outbreaks due to unknown or unsuspected origin, viz., (1) at Quagga's Hoek, in the Melsetter district; (2) the Matopo Hills west of the Malundi River and adjoining farms; and (3) Sauerdale, in the Matobo district. The total mortality was 765, as compared with eight fresh outbreaks and mortality of 798 during the preceding year. Whilst the number of cattle and the extent of the areas involved were greater than in the preceding year, due entirely to the extensive spread of infection in the Matopos before discovery, the position generally is claimed to have improved considerably inasmuch as the disease was in evidence in three districts only, as compared with five in 1919. In the Melsetter district there were five farms in quarantine at the beginning of the year, but subsequently four were released as no case of the disease had occurred therein for 15 months. A serious outbreak, however, occurred in January at the farm Tarka, forming part of the Tilbury estate, on an adjoining part of which an outbreak had occurred in March, 1919. Both these outbreaks are traced back to some deaths which occurred in this area towards the end of 1918. An outbreak occurred in December on the farm Quagga's Hoek in the northern section of the district 30 miles in direct line from Tilbury, and it was found impossible to account for the origin of this infection, although in 1915 a severe outbreak had occurred on this farm. In the Gwelo district the mortality at a single centre persisted until June, viz., a period of 13 months after the discovery of the disease. In the Mazoe district mortality persisted at the original centre of infection until March, a period of 10 months from the commencement of the outbreak, and during the year the disease was discovered on three adjoining farms; the degree of infection, however, was mild and the mortality relatively small. In the Umtali district there was one infected centre at the beginning of the year, viz., at a farm (N'odzi), where a solitary case had occurred in December, 1919; no further suspicious cases occurred during the year. In the Victoria district there was one infected centre at the beginning of the year, viz., upon a farm (Morgenster), where the last death had been recorded in February, 1919; all restrictions were removed at the end of May. After seven years of freedom from the disease in Matabeleland, two outbreaks occurred in the Matobo district, the first amongst native cattle in the Matopo Hills in January, and the second in one of the subdivisions of Sauerdale in June. In the former a fairly large area was found to be involved when the disease was detected, and failure to suspect it earlier was largely due to the co-incident prevalence of black-quarter. Considering the extent of the area, the large numbers of cattle on it and in the vicinity, it was surprising that the infection had not spread to a much greater extent. At the Sauerdale centre infection was restricted to one herd on a well-defined area. There was no definite information as to the source of infection in either case.

The Cattle Cleansing Ordinance of 1918 was applied on September 17th, 1920, over a still larger portion of the territory. During the present year it is hoped to extend its operations further and soon to have no portions of the country inhabited by an appreciable number of cattle exempt from effective and regular dipping.

An attached schedule gives the following aggregate figures :—

Farms occupied by Europeans and natives: Farms 2,696; tanks 1,443. Cattle dipped: European 796,608, native 158,526; undipped: European 6,602, native 37,277.

Reserves and unsurveyed land: Tanks, 196. Cattle dipped: European 2,942, native 343,939; undipped: European 370, native 71,415. According to these figures the total number of cattle in the territory would be—European 806,522, native 611,137.

The total number of cattle dipping tanks is also 1,639, which is 294 more than in 1919, With regard to the idea of having a tank on every farm, the Melsetter district comes nearest, with 101 occupied farms possessing 103 tanks; however, it is noted that there were as many as six tanks on one farm. Great difficulty was experienced in obtaining material and labour for the erection of these tanks, otherwise a larger number would have been completed. It is noted that more European owned cattle were dipped in 1920 than existed in the country in 1919. It is not believed that all the cattle are being dipped regularly every seven days in accordance with the provisions of the Cattle Cleansing Ordinance, although probably the great majority are being thus treated; owing to the insufficient number of tanks, cattle have often to be travelled a long distance, and hence a minority is not strictly conforming to the regulations. It is surprising to find such a number of native-owned cattle on reserves and uninhabited land being dipped. It is estimated that on farms an average of 660 cattle is dipped at each tank. On native reserves the average is about 1,700 head. There is a considerable divergence in the number dipped per tank in the various districts. In the Melsetter district one tank serves an average of 212 cattle, whereas in the Chibi district a tank serves for 3,200 head. In the Charter district there is only one tank to every four farms.

Tuberculosis.—The pure bred herd of shorthorn cattle on the British South Africa Company's Shangani estate was submitted to the tuberculin test, as the disease had been diagnosed in two young bulls purchased from this estate. Thirty-five out of the 300 animals were found to be infected and 19 were regarded as suspicious. The affected ones included a number of valuable cows and bulls. Steps are being taken to eradicate the disease, and all cattle sold out of the herd in 1919 and 1920, prior to the discovery of the disease, are being subjected to the tuberculin test. The actual source of the disease could not be traced, but there is little doubt that it was conveyed to the herd by some heifers purchased in the Union of South Africa. Cattle imported into Rhodesia from overseas have been tested on arrival, whereas those from the Union have so far been exempt from the disease. This is only the second occasion in the history of Southern Rhodesia that tuberculosis has been diagnosed in a herd of well-bred cattle.

Since 1916 upwards of 88,000 head of cattle from Southern Rhodesia have been slaughtered at the Johannesburg abattoirs, and only 30 cases of tuberculosis detected amongst them.

Blackquarter (*Quarter Evil*).—This was the cause of considerable mortality in nearly every district. It would appear that fewer adult cattle were infected, and where the infection had been established for some years the seasonal mortality showed a marked decrease. Of the newer vaccines the filtrate, aggressin, and Leclainche and Vallée's vaccines have been largely used, and the last-named is said to have given most satisfactory results.

Anthrax.—Seven fresh outbreaks of anthrax occurred, with a mortality of 18 head, as compared with 4 and 105, respectively, during the previous year. Vaccination of in-contacts by means of Pasteur's double vaccine was largely resorted to, with strikingly beneficial results.

Contagious Abortion was detected in 36 herds in which its previous existence had not been known or not suspected by the Department.

Senkobo.—This is a native name for a skin disease of cattle, which has been described as a contagious impetigo. It appeared in a limited area of the Wankie district five or six years ago, and since then it has been more or less in evidence. It is believed to have been introduced from Northern Rhodesia, where it has been recognized for many years (see HORNBY, this *Bulletin*, 1920, Vol. 8, p. 232). In the form observed in the Wankie District the lesions generally appear on the hairless portions of the body and gradually extend, particularly to the back. Cases were observed in sheep and goats, in which the lesions were generally found on the head, and especially on the lips and ears. The Bont Tick (*Amblyomma hebraeum*) is suspected to be the transmittor; in the Wankie district the disease has been observed only where this tick is present. To effect a cure, treatment in the early stages is essential, and paraffin is stated to have given the best results.

Ephemeral Fever, or three-day sickness, of cattle was prevalent in several districts during the summer months and, as usual, there was practically no mortality.

An extraordinary complaint, known as *Sweating Sickness*, causes somewhat heavy mortality amongst calves during the rainy season. Treatment was of no avail, and 75 per cent. of affected animals succumbed.

In the Melsetter and Hartley districts the mortality amongst cattle due to *trypanosomiasis* was considerably less than during the previous year. In the Wankie district a large number of deaths occurred, but reliable statistics are not available.

Myiasis was not nearly so prevalent in cattle as during the previous year.

The total number of deaths among horses and mules during the year from *horse sickness* was reported to be 124, as compared with 89 during the previous year. The District Veterinary Surgeon of Victoria reported that more animals died between May and September than during the so-called horse-sickness season. In the Melsetter district the heaviest mortality occurred during the months of June and July. The results achieved by the process of immunization against this disease have proved to be most satisfactory, and it is held that in a few years time sufficient horses can be bred in Southern Rhodesia for local requirements.

There was no case of *glanders*.

The serious outbreak of *epizootic lymphangitis* which occurred in the Mazoe district in 1919 appears to have been satisfactorily dealt with. No fresh cases occurred amongst the animals involved, or elsewhere in the territory.

A schedule is attached showing the numbers of stock imported and exported.

REPORT OF THE VETERINARY BACTERIOLOGIST.

During the year, 1,827 preparations were received for diagnosis at the laboratory. East Coast fever was detected in 167, infectious abortion in 75, blackquarter in 133, anthrax in 16, trypanosomiasis in 5, and tuberculosis in 4.

Contagious Abortion in Cattle.—About 36 new areas were detected and the disease is far more widely distributed than was anticipated.

At a Conference of Provincial Officers of the Veterinary Department, held in August, it was decided that official quarantine of infected farms and herds was impracticable, and publication of notices regarding the disease was not desirable. It was considered that the only method at present available for limiting the spread of the disease lies in the power of veterinary officers to refuse permits for the removal of suspected cattle. The best method of controlling the disease is to educate and assist the public. In order to detect the nature of an outbreak, samples of blood should be collected, by Bevan's modification of the pipette method, to be tested by means of the agglutination test. Veterinary officers should warn and give advice to buyers contemplating purchase of animals likely to be infected. The reports received regarding the efficacy of the vaccine prepared at the veterinary laboratory were most satisfactory. The danger of the bull as a source of infection was discussed, and it was decided that all bulls in infected herds should be tested and destroyed if they showed a positive reaction. Non-reacting bulls should be removed from the herd for six months and vaccinated with " devitalized " vaccine. All female stock in an infected herd, together with calves should be vaccinated also in this way. New stock should not be introduced until a normal calf crop indicated immunity of the herd, and such new stock should be inoculated. " Queen " cows were considered to be a source of danger, and should be destroyed if they reacted to the test. The vaccine should be issued through the district veterinary surgeons in order that they may become aware of the existence of the disease in their district. Subsequent injections might be performed by the owner.

The so-called " devitalized " vaccine referred to was prepared in the laboratory by a method " intended to conserve as far as possible the integral properties of the organism and its toxins but to render them incapable of infecting pregnant animals or setting up a new focus of infection." The results obtained after the use of this product have been " such as to justify its general application." A table is given showing " the remarkable cessation of abortions in treated herds after the vaccination process." [The results are not entirely convincing inasmuch as no controls appear to have been left in the vaccinated herds.—Ed.] It is maintained that " in untreated herds such favourable results have certainly not been observed; on the contrary the infection has continued with increasing severity." In 17 out of 21 outbreaks where the full treatment was applied abortion completely ceased. It was noted that a well-marked reaction occurred sometimes in the udder of vaccinated cows ; 14,000 doses have been produced. Three injections of the vaccine are applied at intervals of one month between the first and second, and two months between the second and third periods. It would appear that in experimental cases the reaction to the agglutination test in infected animals became negative after such treatment.

Horse sickness.—Considerable progress was made in the inoculation of horses and mules against this disease. In addition to having discovered a virus-vaccine of suitable virulence Bevan claims to have determined a method whereby large quantities of it may be prepared. Inasmuch as the principle of immunization depends upon conveying to the inoculated animal a mild attack of the disease, it follows that the natural susceptibility or resistance of the animal is an important factor. The selection of a suitable virus is therefore difficult. The individual susceptibility of animals is to a large extent unknown. Mules are known to possess a high degree of resistance and during the year 511 doses of vaccine were issued and applied to mules with but one death. A similar but less marked resistance is also possessed by young horses, and a course of inoculation was applied to 516 horses under 2½ years old with a loss of 28 animals, or 5·42 per cent. It was found that some of these young animals refused to react and thus derived no additional immunity, as evidenced by the fact that the animal is left, with increasing age, as susceptible to natural infection as an untreated animal. The resistance has been thought to be greatest in foals from "salted" parents and to be derived from the milk of the immune mother. It was therefore decided to postpone when possible the inoculation of young horses until they had been weaned.

Inasmuch as the natural immunity of an animal that does not react tends to die out, it is recommended that the inoculation be applied yearly. Seventy animals were re-inoculated during the year, with two deaths.

In 1919, 207 young horses were inoculated and reports have been received of the death of 12 only of these animals. Many of these deaths are attributed to careless treatment. Inoculated horses not infrequently suffer as the result of re-infection with a natural virus of a different strain to that against which they have been immunized, but the great majority of such animals recover if the reaction is detected and the animal is carefully looked after. It is noted that out of 286 inoculated police horses exposed during the year only two died of horse sickness. The greater mortality among privately owned horses suggests that they are not treated with equal care.

Whereas inoculation of young horses was entrusted to the District Veterinary Surgeons the immunization of older animals was carried out by Bevan himself. Two hundred and sixty-seven horses were thus inoculated, the average age being approximately five years, with a mortality of 7·86 per cent. The high mortality is attributed largely to deaths among the older horses. Condition is, however, a more important factor than age, horses in a good hard-working condition being the best subjects.

During the year Bevan inoculated 176 remounts for the British South Africa Police and three for the Northern Rhodesia Police. The work, however, was rendered more difficult by the occurrence of strangles. The death-rate was 7·6 per cent. as against 13·8 per cent. for the previous year. Forty-one horses imported for distribution to Cattle Inspectors were inoculated, with one death.

Piroplasmosis and Anaplasmosis (Plasmoses) of Cattle.—During the year vaccine was issued for inoculation against redwater and gall sickness on farms where dipping of cattle had been practised for some time and the ticks which transmit these diseases had been eliminated. The cattle bred upon such farms would therefore not contract these diseases during their early days and would subsequently possess no immunity during adult life. When removed to areas where dipping is not practised or where ticks have not been completely removed, they would thus be liable to contract the above diseases in an acute form. To provide against these disadvantages inoculation of calves with a standardized attenuated virus is recommended, but the demand for the vaccine does not appear to have been as great as was anticipated. Great improvement is claimed to have been effected in the method of inoculation by adopting a "double process," viz., by inoculating animals first with a very mild virus, which partially protects them against a second virus that is sufficiently strong to render them immune against natural infection. This method was applied to valuable imported animals which could not be inoculated by the old single method without grave risk. Forty-three animals were thus treated, with but one death. The application of the method is also calculated to open up a good trade in Rhodesian pure bred and grade stock with Portuguese East Africa.

Blackquarter (*Quarter Evil*).—In the absence of adequate facilities for the manufacture of vaccines for the protection of stock against this increasingly prevalent disease, supplies of material had to be obtained from abroad. In the case of the so-called "germ-free" preparations, which are particularly susceptible to the effects of prolonged exposure to heat and light, this dependence on outside sources has obvious disadvantages. It was observed that in a considerable number of outbreaks in which such preparations were applied cases continued to occur. Re-inoculation of such herds did not always result in the cessation of the disease.

Autogenous vaccines were prepared at the laboratory from material collected by veterinarians in the field and were applied with considerable success, it is stated, in the treatment of a number of purulent affections such as mammitis, vaginitis of cattle, septic lymphangitis, lymphangitis following the bite of the "striped-leg" tick (*Hyalomma aegyptium*), strangles in horses, and pyaemia in dogs.

UNION OF SOUTH AFRICA. **Report of the Veterinary Division** [GRAY (C. E.), Principal Veterinary Officer] **for the Year ended 31st March, 1919.** Dept. Agric. Rept., with Appendices. Appendix 1. pp. 33–42. 1920. Cape Town: Cape Times, Ltd., Government Printers. [Price 7*s*. 6*d*.]

——. **Report of the Veterinary Division** [BORTHWICK (J. D.), Acting Principal Veterinary Officer] **for the Fifteen Months from 1st April, 1919, to 30th June, 1920.** 1921. Cape Town. [Price 4*s*.]

EAST COAST FEVER.

This disease continues to monopolize attention in many parts of the Union. The situation is generally improved, but nevertheless the progress made has been so slow that no hope is entertained of ultimately eradicating it. The most that can be expected under present conditions is to control the disease until such time as the farming community are prepared to make greater sacrifices, but difficulties were encountered owing to conditions arising out of the war, notably (1) the prohibitive price of fencing material, and (2) the increased cost of dipping materials. The influenza epidemic which occurred in October, 1918, also added considerably to the difficulties. There was, in addition, a shortage of veterinary staff due to an absence of members on active service. Among the farming community there is a progressive minority which is anxious to submit to more rigorous restrictions to get rid of the pest. The provision of a staff of officers, however, to enforce compulsory dipping in a district where such a measure would be inacceptable to a majority of residents is financially impracticable and so-called compulsory dipping at the prescribed interval is not likely to do anything more than reduce the numbers of the East Coast fever ticks to an extent that might render the early detection of outbreaks more difficult.

Some enthusiasts have suggested that the restrictions should be withdrawn and farmers left to protect themselves by their tanks, but the extreme scarcity of tanks in many parts points to the fact that their benefits have not yet been realized by many farmers, and, therefore, withdrawal of the present restrictions would immediately be followed by disaster to those sections of the community which practice regular dipping. The chief difficulties encountered are, apart from the unauthorized movement of cattle from or through infected areas, those which are due to the unfenced condition of farms or public roads, to the removal of stock for winter grazing, and to the universal practice of using cattle for transport purposes. It would be wise to introduce a zone system under which movements of cattle for transport purposes were only permitted within the boundaries of a more or less definite area. The presence of the native is held by many to constitute an insuperable obstacle to the eradication of the disease, but Gray does not share this view, as experience has shown that although it is often introduced into native areas by illicit movements and is sometimes difficult to eradicate, the average native responds fairly well to pressure judiciously applied by an official in whom he has confidence. The present East Coast fever position in Rhodesia, Swaziland, and many parts of the Transkei showed that the task of dealing with outbreaks in native areas is in many respects simpler than in districts occupied by a mixed population, where there is a constant demand for permits for the movement of cattle for transport and other purposes, and where a refusal does not necessarily suffice to prevent movement taking place.

Cape Province.—In the year 1918–19 there was only one outbreak, in a native location in the Dongwe area, obviously an extension from a previously existing centre. The disease was arrested by short-interval dipping; no deaths have occurred since May, 1918, and at present the Cape appears to be entirely free from the disease.

Transvaal.—In 1918–19 seven districts were infected—Barberton (11 fresh outbreaks), Pietersburg (6 fresh outbreaks), Zoutpansberg, Pietretief (5 fresh outbreaks), Carolina, Ermelo, and Waterberg. In the Barberton district a very serious setback was sustained, which could only be attributed to illegal movements and deliberate attempts to conceal the disease, with the result that the labour of years was undone. In 1919–20 a serious reverse was again experienced by the appearance of the disease in the Pretoria district, which had been free for many years. An outbreak was also reported in the Lydenburg district after a lapse of several years, close to the Barberton border. Fresh outbreaks were reported in Barberton, Pietersburg, Zoutpansberg and Pietretief. In Carolina and Ermelo, on the other hand, all quarantines were withdrawn.

Natal.—In 1918–19 slow progress was reported and an increase of staff for dealing with suspected outbreaks was needed. The work of providing dipping facilities for native owners was progressing steadily, but comparatively little progress was made in this respect in many parts. The number of outbreaks was 195, as compared with 247 for the previous twelve months. In 1919–20 there were again 115 fresh outbreaks, and the Senior Veterinary Officer believes that no appreciable progress is now being made in the eradication of the disease, although it is being controlled and a satisfactory increase in the number of cattle is taking place.

Transkei.—The progress made in combating the disease in native territory in 1918–19 exceeded Gray's expectations, especially in those areas where adequate dipping facilities were provided, but there are still areas in this territory where there is an insufficient number of tanks, and the natives are antagonistic. In 1919–20 it was again reported that it was in the Transkei and native territories that most progress was being made in eradicating the disease. Nine districts were declared free, and in four districts there was only one infected area in each district. Again, in six districts the outlook was good, and excellent progress was made in another district, but four districts were still regarded as wholly infected. Much of the progress in combating the disease has been due to the efforts of the General Native Council, which has persevered with its programme of tank erection.

TUBERCULOSIS.

In 1918–19 no further advance in combating this disease was reported, but with the return of the veterinary staff it was hoped to take steps in this direction. Progress was also anticipated as a result of the passing of the Public Health Bill and education of the public on the health aspect of this disease in cattle.

Cape Province.—A considerable increase in the number of infected animals in the prohibited areas was reported in 1918–19, the percentage reacting having risen to 4·33 per cent. In 1919–20 the percentage of reactors found amongst cattle tested prior to being allowed to leave the prohibited areas—Cape and Stellenbosch—remained about the same. The disease remained very prevalent among housed cows in these areas.

Transvaal.—In 1918–19 it was concluded that there was no real falling off in the number of outbreaks and nine outbreaks were detected in 1919–20.

Natal.—The disease was discovered on five properties in 1918–19; 2,730 head of cattle were tested, of which 83 reacted. In 1919–20 there were eight outbreaks.

Orange Free State.—The test of a herd in 1918–19, which had been in contact with an Ayrshire bull found affected in the preceding year showed seven reactors. Twenty-one cases were reported from Johannesburg and Durban abattoirs—14 cattle and 10 pigs. In 1919–20 no outbreaks were located in the State, but as 58 cases were found at abattoirs among cattle from the Province there is no doubt as to its existence, but it was found impossible to locate in-contact animals.

Transkei.—In 1918–19 two cases were found among cows imported from Cape Town, and of 15 in-contact animals tested seven reacted and were destroyed. In 1919–20 two cases were again recorded, one at Kokstad and one at Umtata, both in imported Cape cows.

Imported Reactors.—In 1918–19, 360 imported cattle were tested at the quarantine stations in the Cape Province (Cape Town, Port Elizabeth, and East London). Twenty reacted and were destroyed, but of this number the existence of the disease could not be demonstrated in six animals. One hundred and forty-eight imported cattle were also tested at the Durban quarantine station and at Maritzburg; of which 17 reacted and were slaughtered. It was probable that the high percentage of animals which showed no lesions post-mortem after giving typical reactions was due to the fact that they had not yet had time to develop macroscopic lesions after exposure. The Pirbright testing station in England now enables importers to have their animals officially tested before shipment. In 1919–20, 258 cattle passed through the Cape Province quarantine stations, six reacted and were destroyed, in one of which the existence of the disease could not be proved. At Durban 174 animals underwent the test; 17 reacted, in two of which no lesions were found post-mortem.

ANTHRAX.

Cape Province.—In this Province anthrax is regarded as the most serious disease the veterinary staff has to contend with, and in 1918–19 it was responsible for more losses amongst farm stock than the total loss from all other contagious diseases. In spite of the warnings issued, stockowners have failed to realize the danger of skinning and cutting up the carcases of animals which have died suddenly without showing preliminary signs of illness. In this way the disease is spread, and, it is anticipated, will yet continue to spread until the rearing of stock will become impossible in areas particularly favourable for the perpetuation of infection, unless bi-annual inoculation of all classes of animals is resorted to. Again in 1919–20 the position was reported to be becoming increasingly serious. In many areas veld contamination appeared to have become so severe that heavy losses were sustained, even where owners lost no time in inoculating their stock, and repeated inoculations became necessary to check the mortality. In the Cape in 1918–19, 103 outbreaks were dealt with in the course of which 12,325 head of stock were inoculated. In the following year the disease was still prevalent everywhere except in the Karroo; 179 outbreaks were reported, 636 animals died, and 4,354 were inoculated.

In the *Transvaal* in 1918–19 no fewer than 700 outbreaks were investigated, in the course of which 1,500 head of stock died and 67,500 were inoculated. In the following year 973 outbreaks were reported, 550 head of stock died, and 93,600 were inoculated.

In *Natal* in 1918–19 there were 54 outbreaks, with 413 deaths and 17,813 in-contacts inoculated. In the following year there were 96 outbreaks, with 413 deaths and 37,417 inoculated.

In the *Orange Free State* in 1918, 122 outbreaks were confirmed, with 524 deaths and 33,983 animals inoculated. In the following year it was regarded as by far the most serious of scheduled diseases; the number of outbreaks increased to 378, with 3,545 deaths and 81,950 head of stock were inoculated.

In the *Transkei* in 1918–19 the disease was reported to be becoming increasingly prevalent; there were 125 outbreaks, with 250 deaths and a total of 47,522 animals inoculated. In 1919–20 there were 265 outbreaks diagnosed and 52,887 animals were inoculated. Owing to the indifference of the native to the risks incurred in cutting up diseased carcases, which are frequently dissected and eaten, the difficulties of keeping the disease under control are very great.

Gray maintains that unless stockowners pay heed to the warnings and advice of the veterinary department, the Union will find itself at a very serious disadvantage when an endeavour is made to place its wool and hides on the world's markets, as it is scarcely to be expected that other countries will be prepared to run the risk attendant upon the handling of the products.

GLANDERS.

The situation is regarded as generally satisfactory; most owners recognize the importance of this disease and suspicious cases are reported to the authorities. In the year 1918–19, 16 outbreaks were dealt with in the Cape Province; 51 animals died or were destroyed, and 143 in-contacts tested. In 1919–20 there were 18 outbreaks. In the Transvaal in 1918–19 there were 8 outbreaks with 13 deaths, and 77 in-contacts tested. In 1919–20 there were again 8 outbreaks. In Natal there were no reported cases in 1918–19, but next year there was one rather serious outbreak in connection with which 13 died; 102 in-contacts passed the mallein test satisfactorily. In the Transkei there were 6 outbreaks with 9 deaths in 1918–19, and next year there were 2 outbreaks, with 8 animals destroyed. In the Orange Free State in 1918–19 there were 5 outbreaks with 19 deaths; next year there were 3 outbreaks and 9 animals destroyed.

CONTAGIOUS BOVINE PLEURO-PNEUMONIA (LUNG SICKNESS).

The Union is still free from this disease, although it is extremely prevalent in the northern part of the Bechuanaland Protectorate, where, in 1918–19, about 52,000 in-contacts were inoculated and collected in numerous concentration camps. During the influenza outbreak in October 1918, large numbers of these cattle strayed, and it was feared that the disease might in this way be introduced into the Union. However, next year the Union still remained free from the disease, although cases were reported right on the northern border.

EQUINE SCABIES (MANGE).

In 1918–19 outbreaks occurred in various parts of the Union, but none of them was serious, and they were confined chiefly to equines that were not well looked after. The numbers of outbreaks were: Cape 67, Transvaal 71, Natal 1, Transkei 5, and Orange Free State 5. During the following year there was a recrudescence of the disease in the Cape Province, probably, it is stated, owing to the loss of condition among equines during the period of drought. There were 129 outbreaks, in the course of which 35 died and 334 were placed under observation or treatment. In the Transvaal there were 64 outbreaks, none of which was extensive, in Natal 2, in the Transkei 4, and in the Orange Free State 3.

EPIZOOTIC LYMPHANGITIS.

In 1918–19 there were 13 outbreaks in the Cape, all in the Humansdorp district, and next year there were 4 outbreaks—3 in Humansdorp and 1 in Port Elizabeth; the improvement is attributed to the prompt destruction of infected equines, thorough disinfection, and isolation of in-contacts. There were no outbreaks in the other Provinces, except 2 in Natal in 1919–20.

CONTAGIOUS ABORTION OF CATTLE.

The regulations framed for dealing with this disease were withdrawn, as its arrest by legislative measures proved to be impracticable. The

Department now advises those who consult it as to the steps they should take for protecting themselves and checking the spread of outbreaks, but the policy of imposing quarantines of practically indefinite duration upon herd owners has been discontinued. Experiments in immunization are being continued. The disease is much more prevalent amongst both European and native stock in the Union and adjacent territories than the Department formerly had reason to believe.

SWINE FEVER.

This disease appears to have occurred in the Cape Province, where, in 1918–19, there were 11 outbreaks and next year 7 outbreaks, involving the death or destruction of 496 animals.

DOURINE (SLAPZIEKTE).

In 1918–19 a number of farms in the Herbert district, where the disease had been prevalent in 1916, was visited, but no active cases of the disease were found, although losses on these farms were said to have been considerable. Specimens of blood from animals said to have recovered from the disease were sent to Canada to be tested. Two were negative, one positive, and the fourth doubtful. It appears that a few outbreaks of the disease occurred on farms in the South-west Protectorate. In 1919–20 the disease was still confined to the Hay, Herbert, and Barkly West districts of the Cape Province, but it was also suspected to exist in the Kuruman and Vrijburg districts, and possibly also in the Boshof district of the Orange Free State.

RINDERPEST.

Reference has been made already in this *Bulletin* to the work of the Rinderpest Commission, which completed its operations in 1918 by establishing an immune belt of cattle in a stretch of country extending from Lake Nyasa to Lake Tanganyika; approximately 100,000 head of cattle were inoculated, with an average mortality of not more than 5 per cent. The mortality included deaths which occurred in a stretch of country in the vicinity of Lake Tanganyika where the cattle proved to be susceptible to redwater. Some members of the Commission narrowly escaped capture by Von Lettow's forces when they invaded Rhodesia a short time before they surrendered. As Von Lettow took a large number of cattle through the immune belt, some of which subsequently developed rinderpest after entering Rhodesian territory, it was fortunate that the Commission was able to deal with the situation which thus arose. Otherwise the work of the Commission might have been completely undone. After the withdrawal of the Commission, patrols were continued along the northern border of Nyasaland and Rhodesia, and in the 1919–20 Report no extension of the disease south of the belt is recorded.

NON-PROCLAIMED DISEASES.

In 1918–19, in the Cape, lamziekte was prevalent on the "sour" veld areas which did not obtain good summer rains.

There was scarcely any horse sickness or blue tongue (in sheep), but in the border districts there was considerable mortality amongst small stock from internal parasites after the wet season of 1918. In the Transvaal blackquarter was very prevalent and caused heavy losses, especially in native locations. Six hundred and sixty-six mules were inoculated against horse sickness in 1918–19, with a total loss of three animals. In the Orange Free State blue tongue was mild and 41,112 doses of vaccine against this sheep disease were issued; out of 18,616 sheep concerning which reports were obtained, there was a mortality of 49. All animals, however, were visibly ill after inoculation. A condition known as white liver (apparently in sheep) is noted and believed to be due to the ingestion of some plant.

Anaplasmosis was fairly prevalent in the Orange Free State and the gross character of tick infection on many farms in this State is commented upon.

Owing to the prevalence of wire-worm (*H. contortus*) the demand for the Government remedy (see VEGLIA, this *Bulletin*, 1920, Vol. 8, p. 26), continued to increase. Favourable reports as to its effects were received.

Three Days' Sickness (Ephemeral Fever in Cattle) was prevalent in the Midland districts towards the end of 1919 and led indirectly to the death of considerable numbers of cattle, which had become reduced in condition owing to the drought.

Again several outbreaks of lamziekte were reported from the " sour " veld coastal districts during the early summer months.

In the 1919–20 Report, blue tongue is again stated to have been not particularly prevalent, but several outbreaks of heart water were reported from Somerset East, Albany, and Cradock divisions; these are attributed probably to the movements of sheep to coastal districts to escape the drought, where they probably picked up infected bont ticks. In the Transvaal, Natal, and Orange Free State there was no non-proclaimed disease of any importance during this year.

In the Transkei, blue tongue was very prevalent towards the end of the summer and a considerable mortality resulted therefrom, as very little inoculation had been carried out before the summer commenced.

Experiments on dunziekte or " grass staggers " are being continued at Usherwood, near Kokstad, with, it is stated, interesting results. Muzzled horses running on an area that had a bad reputation for this disease remained free from it, but a considerable number of animals so muzzled developed osteoporosis.

Wire-worm infection was very prevalent in 1919–20 amongst native sheep. Horse sickness was confined to the Port St. John's district, where numerous deaths were reported.

Meat Export.—In the 1918–19 Report the prospects of an expansion in this trade were stated to be encouraging, although the average quality of the meat killed for export is somewhat inferior on account of the defective conformation of the animals and lack of exact knowledge of the requirements of overseas buyers. Also a shortage of efficient or of effectively insulated trucks handicaps up-country killers. Again in 1919–20 meat export was carried on " to a limited extent " as indicated by the Export Return.

Importation of Stock.—Owing to the prevalence of foot-and-mouth disease in Holland, importation of cattle, sheep, goats, and pigs from that country has been prohibited until further notice. Again, in 1919–20, arrangements were made for the admission of Rhodesian cattle into the Union for re-stocking purposes, in order to meet the needs of settlers taking up land in the Northern Transvaal, where climatic conditions are unfavourable for cattle which are subject to redwater and gall sickness. A large camp was thus fenced in near Liebig's Drift, where cattle were confined for a month before they were released. During the year 67,390 head of cattle were introduced into the Union for slaughter purposes and 29,991 for re-stocking.

PHILIPPINE ISLANDS. **Reports of the Veterinary Division** [YOUNGBERG (Stanton), Chief Veterinarian] **for the Years 1918–19–20.** *Eighteenth, Nineteenth, and Twentieth Annual Reports of the Bureau of Agriculture for the Fiscal Years ended December 31st, 1918, 1919* and *1920.* Manila: Bureau of Printing.*

Rinderpest.—This disease appears to be the most serious cause of losses among the cattle of the Philippine Islands. The number of fresh cases reported during the three years 1918–19–20 was 21,586, 16,228 and 22,442, and the number of deaths 15,747, 11,085 and 16,911, respectively. The actual losses were probably larger than these figures would indicate as, owing to a shortage in the veterinary staff, the records are not complete. The present epizootic first assumed serious proportions in 1916, and, although there are signs that it is abating in virulence, the position is still far from satisfactory as compared with the last normal year, 1915, when the number of deaths was only 2,305. The measures adopted to control the spread of the disease have consisted of strict quarantine combined with the use of serum. It was found that the use of serum alone was not sufficient to prevent the disease from spreading. For the purposes of control the Islands have been divided into districts, and a qualified veterinary surgeon assigned to each with a small force of live stock inspectors under his control. Immunization by simultaneous inoculation has also been practised as far as circumstances would allow, and the results obtained by this method have been very satisfactory, less than 1 per cent. of the immunized animals subsequently contracting the disease. Some difficulty has been experienced in obtaining a constant supply of animals for inoculation owing to the fact that the inhabitants become indifferent as soon as the disease shows signs of abating in their districts.

Foot-and-Mouth Disease.—The disease was introduced in 1918 in a very virulent form by cattle imported from French Indo-China. The whole consignment was placed in strict quarantine and slaughtered immediately, but in spite of all precautions the disease spread to the native cattle and resulted in considerable loss and inconvenience. It continued throughout the whole of 1919, but during 1920 there were only two outbreaks which soon became extinct.

Haemorrhagic Septicaemia.—This disease is fairly widespread and usually occurs at the beginning of the rainy season, but does not cause very serious losses.

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* Abstracted by Mr. T. J. Bosworth, B.Sc., D.V.S.M., M.R.C.V.S.

Surra.—Owing to the heavy demands of the anti-rinderpest campaign it has not been possible to undertake any measures against surra. The disease, however, is very widespread.

Contagious Abortion.—During the year 1920 several suspicious cases occurred in a Manila dairy. The disease had not previously been reported in the Philippines.

Tuberculosis.—This disease appears to be practically non-existent amongst native cattle and carabaos. Several cases have occurred among some Berkshire pigs imported from U.S.A. The intradermal tuberculin test has been employed for diagnosis and has given good results. Measures are being taken to stamp out the disease.

Research Work.—Attempts have been made to locate the various seats of rinderpest virus in the animal body by making extracts from various organs and inoculating them into susceptible animals after storing for various periods of time. The organs in which the virus is especially situated proved to be the liver, spleen, lymph glands, heart, fourth stomach, caecum and colon. Extract of skeletal muscle was not infectious. The virus appears to multiply, therefore, inside the tissue cells and the virus in the blood stream is merely a surplus which is thrown off from these cells. Organ extracts can be used in the place of virulent blood for simultaneous inoculation and also for hyperimmunization, and thus a much larger supply of virulent material is obtainable from any one animal. A 0·5 per cent. phenol extract of liver, spleen and lymph gland will hold the virus of rinderpest in a virulent form as long as 55 days.

The report claims that a "vaccine" for rinderpest has been prepared, which gives promising results as a preventive. [The method of preparation is not given.—J.T.E.] Means have been found of keeping it potent for 60 days, so that it can be thoroughly tested before issue. In the laboratory tests it was administered to highly susceptible animals in two doses of 10 cc. each with an interval of from 7–10 days. One week after the last injection the test animals were exposed to infection, being inoculated subcutaneously with virulent blood and placed in contact with sick animals. All remained healthy. In field tests the dose given was 20 cc. for adults and 8–15 cc. for young animals. In all, 4,433 animals have been vaccinated in districts where rinderpest is rampant, and this procedure is said to have contributed to a speedy disappearance of the disease.

A vaccine for *Hog Cholera* is being developed along similar lines, and has so far given promising results. In the case of hogs the two vaccines are mixed so as to afford protection against both diseases.

An outbreak of *Anaplasmosis* was diagnosed in Lipa Batangas among cattle, but carabaos appear to be immune.

BOOK REVIEW.

PILLERS (A. W. Noel). [F.R.C.V.S., F.Z.S.] **Notes on Mange, and Allied, Mites for Veterinarians.**—pp. xii+110. With 68 figs. Demy 8vo. 1921. London: Baillière, Tindall & Cox, 8, Henrietta Street, Covent Garden. [Price 12*s*. 6*d*. net.]

This little book will no doubt prove useful to many besides the professional veterinarian. It deals briefly with the wholly parasitic mites that commonly attack the animal epidermis, and also the food-mites which, as is well known, not only may get on to animals but, when numerous, may sometimes become parasites of their fortuitous hosts; nor are the useful forms, such as Cheyletus, that prey upon their harmful fellow-mites, forgotten. It also contains practical directions for treating mange and scab.

A. Alcock.

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Compiled by MISS M. H. JAMES.

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Erratum . Vol. 10, p. 39, third para. The bracketed insertion should have been deleted in proof. The genus *Bustomum* was created by Clayton LANE (1917), *Indian Jl. Med. Res.*, Vol. 4, p. 419.

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TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY BULLETIN.

VOL. 10.] 1922. [No. 1.

DISEASES DUE TO PROTOZOAN PARASITES.

DRY (F. W.). **Trypanosomiases in the Absence of Tsetses, and a Human Disease possibly carried by Simulium in Kenya Colony.**—*Bull. Entom. Research.* 1921. Nov. Vol. 12. No. 3. pp. 233–238. With 2 plates.

The first part of this paper describes investigations carried out with a view to tracing the means by which a number of cattle contracted trypanosomiasis (*T. uniforme*). The possibility of Simulium being concerned was examined, but no evidence indicative of that was obtained. Stomoxys was probably the transmitting agent.

BESSEMANS (A.). **Effect du chauffage sur les sérums de cheval dans la réaction de Bordet-Gengou pour la diagnostic de la Dourine.** [The Effect of Heat upon Horse Sera in the Bordet-Gengou Reaction for the Diagnosis of Dourine.]—*C.R. Soc. Biol.* 1921. No. 12. Vol. 85. No. 32. pp. 889–892. With 2 text figs.

The author believes that the anticomplementary power of normal sera in the presence of antigen is due in reality to a real " deviation " of a non-specific type, similar to that possessed by unheated normal human sera in the presence of colloidal antigens in the Wassermann test. This non-specific deviation can be very greatly reduced by heating the serum to 56–58° C. for half an hour. Heating to 60° C. for the same length of time practically destroys it.

MARSHALL (Claude H.). **A Paper on a New Method of Treatment of Human Trypanosomiasis.**—*Jl. Trop. Med. & Hyg.* 1921. Oct. 15. Vol. 24. No. 20. pp. 265–267.

The method described is based upon two principles:—

(1) That the disease is cured, when a cure does take place, by reason of the formation of some trypanolytic antibody in the blood.

(2) That in the majority of cases of trypanosomiasis the parasite sooner or later finds a hiding place in the cerebro-spinal canal, where

it remains unaffected by any drugs given intravenously, subcutaneously or by the mouth, and that it is by its presence in this situation that it ultimately causes the death of the patient.

The essence of the method is that after an intravenous injection of neokharsivan (or atoxyl—in a few cases) blood is withdrawn and allowed to clot. The serum obtained is injected into the spinal canal after an equal quantity of cerebrospinal fluid has been withdrawn.

The best results have been obtained when 0·3 g. of kharsivan has been injected, 30 cc. of blood drawn after three hours, and then 15–20 cc. of clear serum injected into the spinal canal.

One injection seems to be enough.

HORNBY (H. E.) **Trypanosomes and Trypanosomiases of Cattle.**—*Jl. Comp. Path. & Therap.* 1921. Sept. Vol. 34. No. 3. pp. 211–240. With 1 text fig.

This paper is a valuable critical survey of the trypanosomiases of cattle and their causal organisms. The author considers in a few pages, which are full of evidence of the author's mastery of his subject, the various means that have been employed for the differentiation of trypanosomes and comes to the conclusion that the time is not yet for making any hard and fast statements. To quote his words, "It must remain, then, a matter of personal opinion what is the number of true species of trypanosomes occurring in cattle. We are on absolutely sure ground when we separate *Trypanosoma evansi, T. congolense, T. vivax, T. theileri,* and *T. ingens.* Three other trypanosomes sometimes found in cattle, the specific rank of which is recognized to-day by nearly all authorities—whatever the future may hold in store for them—are *T. gambiense, T. brucei,* and *T. uniforme.*" Of these *T. congolense, T. vivax,* and *T. uniforme* are pathogenic for cattle; *T. evansi, T. gambiense* and *T. brucei* to a slight extent only.

The author proceeds to deal with the eight parasites given above individually. The information given is so condensed that this portion of the article does not lend itself to abstraction, and it should be consulted in the original.

An extensive list of papers consulted is given.

DELANOË (P.). **Au sujet de** *Trypanosoma talpae* **Nabarro.** [Regarding *Trypanosoma talpae* Nabarro.]—*Bull. Soc. Path. Exot.* 1921. Oct. Vol. 14. No. 8. pp. 453–455. With 1 text fig.

The author gives the measurements of three trypanosomes, the only three found in five films, stained by TRIBONDEAU's bieosinate-azur method. The average length of the three parasites measured exceeded the maximum given by LAVERAN and MARULLAZ by 8 μ.

DELANOË (P.). **Au sujet d'***Haemogregarina Brendae,* **Sambon et Seligmann.** [Regarding *Haemogregarina brendae* (Sambon & Seligmann).]—*Bull. Soc. Path. Exot.* 1921. Oct. Vol. 14. No. 8. pp. 451–453. With 1 text fig.

The author records the occurrence of this parasite in a specimen of *Psammophis sibilans,* L., captured at Bouake (Ivory Coast). WENYON's account of the parasite found by him in the same reptile occurs in the *Third Report of the Wellcome Research Laboratories,* 1908.

LIGNIÈRES (J.). **Vaccination des bovidés contre l'anaplasmose. Quelques observations sur les résultats des inoculations aux reproducteurs fins, du sang de mouton et de chèvre infecté par passages successifs.** [Vaccination of Bovines against Anaplasmosis with the Blood of Sheep and Goats infected by Passage in Series.]—*Bull. Soc. Path. Exot.* 1921. Oct. Vol. 14. No. 8. pp. 449–450.

Two years ago Lignières published the results of his investigations of anaplasmosis of bovines in the Argentine. At that time he noted that sheep and goats inoculated, although showing no symptoms, harboured the parasite in their blood for long periods. The virulence of the parasite is maintained during the first passages, but in many cases attenuation for the ox occurs, with the result that although cattle injected with these attenuated strains show no evidence of reaction, they acquire a solid immunity.

Inoculations carried out upon valuable pure-bred animals ranging from eight months to two years of age showed that a reaction occurs between the thirtieth and the fiftieth days. Such reactions may be severe. If subcutaneous and intravenous injections of 1 gm. to 2 gm. of quinine are given, the parasites are discoverable in the blood for four or five days only. A fatal result is exceptional. While encouraging results have been obtained up to the present, judgment as to the value of the method must be suspended until an interval of some years has elapsed.

FOURNEAU (E.). **Sur l'emploi de l'acide oxyaminophénylarsinique et des acides arylarsiniques en général dans le traitement des spirilloses et des trypanosomiases.** (*Note Préliminaire.*) [The Use of Oxyaminophenylarsenic Acid and Arylarsenic Acids in general in the Treatment of Spirilloses and Trypanosomiases.]—*Ann. Inst. Pasteur.* 1921. Sept. Vol. 35. No. 9. pp. 571–574.

The author points out that EHRLICH's views regarding the superior value of trivalent arsenic compounds over the pentavalent types are based upon two main conclusions: (1) That neutral salts of arsenic acid have no action upon the parasites *in vitro*, while the derivatives of arsenious acid are very active; (2) even admitting that the activity of the two types may be equal, the arsenic salts must yield in favour of the salts of arsenious acid, because none of the untoward symptoms caused by the former are observed after the administration of the latter.

Fourneau brings the following arguments against these conclusions:—

1. Results obtained *in vitro* are not necessarily those produced *in vivo*; the majority of antiseptics which are active against cultures are without effect upon infected animals.

2. Arsenious compounds are not invariably active *in vitro*. It would appear that factors other than the "arsenite function," favourable or unfavourable from the point of view of antiseptic action, come into play.

3. Arsenites are not always more active *in vivo* than the acids from which they are derived. This is the case with oxyaminophenylarsenic acid and "606."

4. It has not been shown that the nervous symptoms produced are due solely to the "arsenic acid function."

The author's original experiments carried out with German atoxyl, those recently carried out by JACOB and HEIDELBERGER at the Rockefeller Institute, and the author's own later investigations, have led him to think that the nervous phenomena referred to by EHRLICH might possibly be due to impurities in the atoxyl and to the arsenic acid used by HATA. Should this prove to be the case there would be a distinct advantage in the use of the acids in preference to the arsenites.

The author has had prepared by MADINACEITIA (Madrid) and by TRÉFOUEL and PUYAL a certain number of arsenic acids, and animal experiment has established the superiority of oxyaminophenylarsenic acid over all the others.

The sodium salt of this acid has been obtained in a state of purity, and it has been found to be extremely unstable in solution. The author has worked out the conditions for the use of this salt, which he proposes to call "189."

NAVARRO, working with the compound in MESNIL's laboratory, has proved its value in trypanosome infections, and except in cases where maximum doses were given no nervous phenomena have been observed. Solutions which have become oxidized by exposure to air, and have in consequence changed from colourless to brownish, have been proved to be obviously more toxic than the freshly prepared solutions

DISEASES DUE TO METAZOAN PARASITES.

PATTON (W. S.). **Notes on the Myiasis-Producing Diptera of Man and Animals.**—*Bull. Entom. Research.* 1921. Nov. Vol. 12. No. 3. pp. 239–261. With 2 plates and 2 text figs.

In a concluding note to this paper the author says "medical and veterinary officers have unique opportunities of collecting these flies and of studying their habits, but I believe many are deterred from doing so because there is no easily accessible account of these interesting parasites of man and animals; I trust that these notes will in some way fill the hiatus." This valuable paper does not lend itself to abstraction, as it is very largely a detailed descriptive catalogue of the myiasis-producing diptera. An abstract could be made of the portions dealing with the technique of rearing larvae, etc., but this without the remainder would be of little value. Those interested should therefore consult the original.

MAURIAC (P.) & BOYER (R.). **Recherches expérimentales sur le traitement de la distomatose par les injections intraveineuses d'émétique.** [Experimental Investigation of the Treatment of Fluke Disease by Intravenous Injections of Tartar Emetic.]—*C.R. Soc. Biol.* 1921. Nov. 17. Vol. 85. No. 33. pp. 917–919.

Three sheep were given daily and progressive doses of a 4 per cent. solution of emetic. The first received a single series of 16 injections, the total amount given being 0·86 gm.; the second animal was given two series of injections totalling 2·16 gm., and the third three series to the total amount of 3·71 gm.

In no case was any evidence obtained that the drug acted destructively on the parasites.

RANSOM (B. H.). **Intestinal Worms in Hogs and Stomach Worms in Sheep.**—*Cornell Veterinarian.* 1920. Apr. Vol. 10. No. 2. pp. 66–74. With 5 figs.

Of a large number of pigs slaughtered at Chicago rather more than 50 per cent. of those under five months old were found to be infested with *Ascaris suum*, and of those between 18 months and four years old the percentage was 35.

The life-history of the parasite has been worked out by STEWART, FOSTER, and RANSOM recently. The embryos, which hatch out from eggs swallowed by pigs, do not develop in the intestine to the adult worm, but leave the intestine and migrate to the liver and other organs, including the lungs. Those that fail to reach the lungs undergo a certain amount of development, but degenerate and die. Those which reach the lungs can be found there within ten days of the eggs being swallowed, and there they attain a size up to 2·5 mm. (about ten times their larval length).

In the lungs they produce small haemorrhages and oedema. They may induce pneumonia, and death occurs within ten days after infection.

From the lungs the worms pass up the trachea, and down the oesophagus, and thus reach the intestine. Apparently some of the parasites make this circuit from the intestine back to it again very quickly, as it is said that they may be found there within ten days—the same period as that given for the invasion of the lungs. Those which, having reached the intestine again, are passed out with the faeces without establishing themselves soon die. For the complete development of those established in the intestine a period of about two and a half months is required, dating from the original infection with eggs.

The eggs as passed out are not infective, as exposure to air is required for the development of the embryo within the egg. Under some conditions the period required is only ten days, but usually it is much longer. The embryos having reached the infective stage of development within the eggs are very resistant to adverse conditions and may retain their vitality for years. The danger attaching to heavily infected premises is obvious.

Pigs only a few weeks old are more susceptible to infection than old animals, and medicinal treatment is useless if the lungs are heavily infested. Should they survive that phase, then anthelmintics may be given. Santonin and calomel in capsules, in doses varying from 2 gr. to 5 gr. of each, may be given mixed with sodium bicarbonate in the proportion of 2 of this to 1 of each of the other drugs. This treatment usually has to be repeated several times at intervals of a few days. Oil of chenopodium is far more effective, the rate of dosage being 1 mgm. per kilo., or 1 dram per 100 lb, and it should be given only in conjunction with castor oil. Of the latter 1 oz. to 2 oz. should be given. It is dangerous to give oil of chenopodium without the castor oil. The treatment should be repeated after a week or ten days.

Haemonchus contortus. Our knowledge of the life-history of this parasite is due mainly to Ransom (1905) and VEGLIA (1915). The eggs, which are passed out, hatch in about 24 hours at summer temperature. Below 40° F. the eggs lie dormant or die, but some occasionally survive freezing temperatures.

The first 24 hours after hatching are taken up by two equal periods, one of activity and one of rest. Then follows a moult. After this the larva is active for about 36 hours and then quiescent for 8 to to 12. The larva is now in the infective stage, and although it has acquired a new cuticle, the old one is not shed. At this stage of development the larvae are very resistant to adverse conditions and may survive a winter.

When such larvae are ingested they moult, and after about 36 hours become quiescent for a time and again cast their skins and begin to grow rapidly. They attach themselves to the mucous membrane, and by the fifth day the sexes are distinguishable. After a further moult, about 15 days after infection, copulation occurs. The adults live for many months in the stomach, and it was proved experimentally that removal from infected pasture alone was not sufficient to ensure eventual freedom from the parasites. Although the numbers in the stomachs diminish, they may still be found as long as 18 months after the animals have been removed from all possible sources of infection.

Control measures involve the avoidance of low-lying ground, of the use of permanent pastures as far as possible, and of overcrowding. Frequent changes of pasture assist in minimizing the infestation. It requires a period of about a year to clear a pasture after sheep and cattle have been removed.

It was found experimentally that removal of lambs to fresh grazing grounds every three weeks between May and November, and the dosing of all ewes once a month with sulphate of copper until the lambs were weaned, proved very efficacious in controlling the disease, provided ewes and lambs were kept separate after the latter were weaned.

When frequent changes of pasture cannot be given ewes and lambs should be dosed with copper sulphate once every four to six weeks from May till October. A 1 per cent. solution is used, and the doses are $1\frac{3}{4}$ oz. for lambs under one year and $3\frac{1}{2}$ oz. for sheep over one year. The best results are obtained if the doses are given to the animals after fasting overnight, and no water should be given for two hours after the administration.

JACK (R. W.). **Ticks infesting Domestic Animals in Southern Rhodesia.**—*Rhodesia Agric. Jl.* 1921. Aug. Vol. 18. No. 4. pp. 361–371. With 1 plate. (To be continued.)

The object of these articles is to place in the hands of those interested, in handy form, a guide to the ticks infesting domesticated animals, descriptions of their habits, life-histories, the relations they bear to disease, and measures employed for their control.

Ticks are divided into two main families, the most obvious distinguishing feature being the presence, in the case of the Ixodidae, of a hard shell on the back of the tick, and its absence in the Argasidae. This shell covers the entire male, but in the female a small area only close behind the head. In the Argasidae also the mouth parts are invisible from above except in the larval stage.

In all the Ixodidae the life cycle is the same. The six-legged larva hatches from the egg, and on moulting becomes an eight-legged nymph. This nymph moults, and sexually differentiated adults result. The ticks are blood-sucking parasites in all their stages, but the habits of all species are not the same. Some drop off the host and moult on the ground, others remain attached to a single host throughout their cycle. They may be conveniently described as having one, two or three-host cycles.

Hyalomma aegyptium impressum. The bont-leg tick. [The word bont means particoloured.]—These ticks have dark brown bodies and particoloured legs. The tick has either a two or three-host cycle, but generally two-host. This appears to be the only tick in which individual variation of the life habits has been observed. The larvae and (in the two-host cycle) the nymphs of this species are not known to attach themselves to cattle, but feed upon rabbits, hares, etc. The adult ticks are common on cattle, but are not known to transmit any specific disease.

In Africa the hosts of the adults are ox, buffalo, dromedary, rhinoceros, horse, ass, giraffe, sheep, goat, pig, dog, man, poultry and ostriches. Larvae and nymphs have been recorded on hares, rabbits, fowls, ostriches and other birds.

Amblyomma hebraeum. The bont tick.—The shield of the male tick shows brown-black markings, the spaces between being green to yellow. The legs are particoloured. In the female the markings are more variable. The remainder of the back is dark brown.

This tick has a three-host cycle. Eggs require six months or more for hatching in the winter and about two and a half months in the summer.

The larva engorges in about a week, and requires one to three months to moult. The nymph requires about the same length of time for engorgement, and the second moult requires from a fortnight to one and a half months. Females require about a week to engorge. The males remain attached for long periods.

This tick transmits heart-water of the sheep, goat and calf in the South African Union. The tick is not known to occur in Rhodesia.

The adult bont tick has been recorded from cattle, sheep, goats, swine, horses, rhinoceros, giraffe, antelope, buffalo, lion, wild dog, etc.

Amblyomma variegatum. The variegated bont tick.—The male of this species is distinguished from that of the preceding, in spite of the general similarity in the type of the markings on the shield, by the following points: the edges of the shield are dark instead of pale, the light markings are coppery red instead of green. The markings on the shield of the female are variable, and it is sometimes dark without any light patches. The life-history resembles that of the bont tick. Transmits heart-water. Very liable to cause abscesses and sloughing of the skin. This appears to depend to some extent upon the length of the mouth parts.

Amblyomma marmoreum. The tortoise tick.—Not commonly found on warm-blooded animals, but a frequent parasite of reptiles.

Rhipicephalus appendiculatus. The brown tick.—There are many species of this genus, but they bear very close resemblance to each other. Males and females are both uniformly brown when unfed. The engorged female has a slaty-blue colour.

Has a three-host cycle. Larva feeds three days or more. Moult lasts a fortnight or longer. The nymph feeds for four to six days. It is estimated that two complete cycles may be passed in a year.

Transmits East Coast fever. The infection does not pass through the egg. May become infected as larva or nymph and pass on the infection at the next stage. An infected larva feeding on a non-susceptible animal is thereby cleaned and is not infective as a nymph.

Transmits redwater as an adult which fed as a nymph on an infected animal or as a larva derived from a female which fed upon an infected animal—*i.e.*, in this case the infection does pass through the egg.

Transmits gall sickness (*Gonderia mutans*).

Rhipicephalus evertsi. The red-legged tick.—Adults attach themselves for preference under the tail, the nymphs in the ears.

Has a two-host cycle, the larva-nymph moult taking place on one host.

Can transmit gall sickness and biliary fever of horses. In both cases the diseases are transmitted by adults which have fed upon infected animals in the larval and nymph stages (single host).

The parasites of redwater and spirochaetosis (affecting cattle, sheep and horses) are transmitted through the egg.

Rhipicephalus simus. The black-pitted tick.—Has a three-host cycle, and can transmit anaplasmosis.

Rhipicephalus sanguineus. The European brown tick.—Is not limited to Europe, but occurs in Africa and India. In the latter country it transmits canine piroplasmosis (malignant jaundice). This disease may be transmitted in three ways: The progeny of an infected female may be infective as (1) nymphs, (2) adults. Nymphs fed upon an infected animal may become infective as adults (3).

Margaropus decoloratus. The blue tick.—Distinguishable by the pale-coloured legs. The fed female has a greenish blue colour, distinguishing it from the engorged female of *R. appendiculatus*, which is slaty-blue. The tick has a single-host cycle, and the warmth of the body influences the rate at which the life cycle is passed through. Several generations may be passed through in a year.

Where dipping is not practised this is probably the commonest tick, but owing to its single-host habit it disappears most rapidly when dipping is carried out.

Transmits redwater and anaplasmosis, and also spirochaetosis of cattle, horses and sheep. The infection passes through the egg and is transmitted by the larva.

Margaropus witherni. Horse tick.—Is a South American tick which was probably imported into South Africa during the Boer War. The male has very thick legs, the individual elements of each somewhat resembling a rounded bead. The female somewhat resembles that of the blue tick, but is larger, and the outer end of each article in the legs has a dark marking on it.

Haemaphysalis leachi.—This is probably the commonest tick of the dog in Rhodesia. The male tick is uniformly brown and the engorged female very closely resembles the brown tick in the same condition, that is, it is a slaty-blue colour. The head is shorter and broader than that of the brown tick. In the male tick there is a deep uniform groove close to the edge all round the shield except in front.

The tick has a three-host cycle, and probably completes two cycles in the course of a year.

Transmits malignant jaundice, and the manner of transmission is peculiar in that the infection passes through the egg, but the progeny are not infective until the adult stage is reached.

The tick is found mainly on carnivora.

ROUBAUD (E.) & DESCAZEAUX (J.). **Contribution à l'Histoire de la Mouche Domestique comme agent vecteur des Habronémoses d'Equidés. Cycle évolutif et parasitisme de l'***Habronema megastoma* **(Rudolphi, 1819) chez la mouche.**—*Bull. Soc. Path. Exot.* 1921. Oct. Vol. 14. No. 8. pp. 471–506. With 1 plate and 9 text figs.

The equidae are hosts of three Habronema (or Spiroptera): *H. muscae* and *H. microstoma,* which live free in the stomach, and *H. megastoma,* which is to be found in tumour-like growths near the pylorus of that organ.

Apart from these, however, investigation has shown a not inconsiderable number of apparently "erratic" localizations, such as dermatitis, granular conjunctivitis, summer sores, etc. The parasite named *Dermofilaria irritans* by RIVOLTA in 1868 has been shown by many investigators to be a larval Habronema. Other investigators have established the occurrence of a pulmonary habronemosis of horses, also caused by larvae, in this instance of *H. megastoma.*

After summarizing recent work regarding the development of the parasites in the flies and the methods of transmission, the authors proceed to a description of their own experimental work.

Flies ready to lay eggs were caged in wide-mouthed bottles covered with muslin with sterilized horse faeces. When the eggs were laid they were transferred to similar jars also containing sterile faeces.

Stomach lesions due to *H. megastoma* were carefully opened and the contents mixed with tepid distilled water. This was then mixed with the faeces in the wide-mouthed bottles. Larvae and pupae were examined daily. The process of pupation required about a week before it was complete. The pupae were then taken from the moist medium and placed in dry bottles, which were covered with two layers of gauze.

From two to three days later a dozen flies hatched out in two of the bottles. None of those placed in the third jar hatched at all, and the failure to do so was proved to be due to intense infestation with parasites. Many of the pupae in the other jars failed to hatch for the same reason.

The flies in the first jar which had contained larvae four days old contained from 25 to 30 parasites each. Those in jar No. 2, which had contained larvae just hatched, contained from 75 to 150 parasites. It would therefore appear that infestation occurs with greater ease when the larvae are young.

The eggs of Habronema are oval in shape and measure from 40 to 50μ by 9 to 11μ, and they contain an embryo which entirely fills them. The first penetration of the parasite into the fly is certainly passive, and takes place by ingestion. Embryos were found in the digestive canals of larvae two days after sowing out. They were very actively motile, and in some cases had not fully escaped from the egg. These embryos measured from 105 to 110μ in length by 7 to 10μ in thickness. The anterior end is furnished with a stilette with a V-shaped basal armature, but without a sheath. This shows very rapid retractile movements. The body substance is uniformly granular. Curved embryos may be found similar to those observed in the faeces.

The subsequent stages of development occur exclusively during the larval and nymphal stages, in the Malpighian tubes.

The larvae appear to invade these about the third day. Here the motility of the embryo is less marked and the body appears to be shorter and slightly thicker. The posterior end becomes more blunt and shows a clear vesicle.

By the fourth day the stilette has disappeared, and the parasite gradually becomes sausage-like. At the anterior end indications of the pharynx make their appearance, at the hinder end the caudal vesicle is clear and traces of the pyriform rectum make their appearance. Throughout the length of the body nuclei are scattered without apparent order.

At the onset of the nymph stage the parasites are sausage-like again. They are feebly motile, and frequently curved. They range from 200 to 500μ in length by 30 to 35μ in thickness. As the worms grow the differentiation of the organs becomes more distinct, and about 50μ from the anterior end a ring of large nuclei marks the nerve ring.

On the sixth day the epithelial cells of the Malpighian tubes of the nymph enclose the larvae-like cysts, within which the parasites are coiled on themselves. By this time they have entirely lost the sausage shape and are from 600 to 900μ by 50 to 60μ. The oesophagus, intestine, pyriform rectum and nerve ring are clearly discernible. The intestine is about twice the length of the oesophagus. The anus is closed and prominent at a point some 70μ from the posterior end. The mouth and pharynx are very distinct.

By the following day the parasites are nearly twice the size and are surrounded closely by a thin membrane, which represents all that remains of the Malpighian cell. This membrane envelopes the parasite so closely that it appears as if the parasite were moulting. By now the rectum has become elongated and narrow and has taken up a position in direct line with the intestine. The cuticle of the caudal expansion shows beneath it the little spines which are characteristic of Habronema in the definitive stage.

In flies which have just emerged from the pupae the same forms of the parasite are found as in the pupal stage, and these are still enclosed in the remains of the Malpighian epithelium, but they show a gradually increasing degree of active movement. At about the same time free larvae are found in the body cavity. These, as a result of moulting, have acquired all the characters of the mature larvae, including the spines on the caudal expansion.

During the ninth to eleventh days the number of free larvae increases, and in dead flies they literally swarm. The head and thorax are filled with them, as is also the proboscis, which is actually made to move by their activity.

At this final stage of development in the intermediate host the parasites have the following characters: length, 2·7 mm. to 3 mm.; width, 60μ to 85μ. The anterior end shows a constriction which marks off the cephalic portion. The mouth shows a large anterior and posterior lip and two small lateral ones. The oesophagus is of the usual shape and occupies about one-third of the body length The anus opens about 100μ from the posterior end and has a valve-like shape.

The facts observed by the authors indicate that the embryo worms reach the Malpighian tubes by boring their way out of the intestine into the body cavity and thence into the Malpighian tubes from the outside. There are three distinct phases of development of the larvae, separated by moults. While the cycle of development in the fly shows close analogies with the cycles of other members of the Spiruridae and Acuariidae, it differs markedly from these in that there is no encapsulation of the second or sausage-like phase. While the larvae of Habronema become free during the third stage preparatory to passing to the definitive host, the other Spiruridae remain encapsuled and pass into the definitive host in that condition. It was found that faeces retained their infective power for about 12 days at the temperature at which the experiment was carried out (23° C.). Higher temperatures, such as are generated in manure heaps, have a more destructive effect.

None of the infested flies lived more than seven days, and many died the day after hatching, owing to the destruction of the Malpighian epithelium.

The mechanism by which the larvae make their escape from the proboscis is given in detail, and the evidence appears to show that the temperature of the horse, which represents the definitive host of the larva, plays some part in the liberation, as it has been found impossible to get larvae from infected flies by feeding them on any media such as sugar, blood, pus, etc.

Horses probably acquire the parasite through infected flies feeding upon wounds or exposed mucous membranes. Infection through ingestion of dead contaminated flies is probably merely accidental, and one is compelled to think that the larvae reach their predilection seats by their own efforts. It has been proved experimentally that the larvae, if they are to remain alive and carry on their life cycle, must be deposited upon a moist surface. Five minutes on a dry slide proves fatal to them.

In moist media, *e.g.*, tap water, serum, broth, etc., larvae never survived more than 48 hours at ordinary temperatures. At body temperature the duration of life is about the same. They may maintain their vitality for the same length of time in dead flies so long as the tissues of the fly do not become dried up. Thus food and water may become contaminated with embryos from dead flies. No proof has been forthcoming for the hypothesis that the embryos are able to penetrate sound skin, and they do not appear to be able to penetrate the skin when the epidermis alone is damaged. Contrary to the findings of VAN SACEGHEM and in agreement with that of BULL, the cause of summer sores in France is probably *H. megastoma* (supported by one experiment). So far no proof has been furnished of the hypothesis that the larvae found in summer sores can reach the stomach. These larvae appear to be "erratic" and incapable of further development.

The same appears to be the case with the larvae which are responsible for pulmonary habronemosis in France. Those parasites are invariably found in the lumen of the bronchioles. The peribronchitis is a sequel. Those larvae which penetrate into the bronchioles do not appear to live for more than about a week.

The case of *H. microstoma* is possibly different from that of the other two species, since it undergoes development in a biting fly—stomoxys. This fly does not attack the lips and nostrils, but the legs, and the larvae can therefore only reach the lips by indirect methods, such as gnawing.

As might be expected, there is a close relationship between the life cycle of the parasite and the life-history of the fly. During June and July the stomach tumours contain large numbers of eggs containing embryos of Habronema and gravid females. The eggs are therefore expelled when flies are numerous. During August the "tumours" are empty, but larvae identical with those occurring in the flies begin to make their appearance. No mature worms are to be found in the tumours during September, at least the eggs from such gravid females as may be found are not viable. Hot weather therefore appears to be necessary for development. During the winter the growing larvae may be found in the tumours. They mature and the liberation of eggs begins again at the beginning of the following summer.

Sewell (E.). **A Note on the Importance of the Genus *Habronema* as an Economic Factor amongst the Equidae of the Punjab and the North-West Frontier Provinces.**—*Vet. Jl.* 1921. Oct. Vol. 77. No. 10. pp. 381–383.

The author has had the opportunity of making post-mortem examinations of a large number of horses and mules destroyed on account of debility, and in every instance has traced it to the presence of one or more species of Habronema.

Habronema megastoma is responsible for tumour-like growths of various sizes in the neighbourhood of the pylorus, and *H. muscae* and *H. microstoma* may be detected on the mucous membrane of the cardiac portion of the stomach.

An outline description of the life-history of the parasites is given.

The eggs, which are passed out with the faeces, are ingested by the fly maggot, and the embryos eventually reach the thorax and proboscis of the mature fly, and it is supposed that the horse infects himself by ingesting infected flies.

H. muscae and *H. megastoma* have their host in the common housefly, and *H. microstoma* in *Stomoxys irritans.* The fly can only become infected as a larva.

Bursati is probably due to the larvae of the Habronema.

Preventive measures are concerned very largely with the proper treatment of manure with a view to the destruction of the larvae.

Oil of chenopodium is valuable against *H. muscae* and *H. microstoma*, and may possibly be of some service against *H. megastoma.* The possible value of carbon bisulphide is suggested.

van Saceghem regards the following local application as a specific cure for summer sores :—

Plaster of Paris	100
Alum	20·
Naphthalene	10·
Quinine	10·

To be applied after thorough cleansing and disinfection of the sore. The dressing dries the sore rapidly and prevents the attacks of flies.

Bishopp (F. C.). ***Solenopotes capillatus*, a Sucking Louse of Cattle not heretofore known in the United States.**—*Jl. Agric. Research.* 1921. Sept. 1. Vol. 21. No. 11. pp. 797–801. With 6 text figs.

In this paper the author establishes the observation made by Enderlein in 1904 of the new genus and species of sucking louse named in the title of the paper. The validity of the nomenclature was questioned by Ferris in 1916.

Enderlein's original description was based upon the examination of a single male. In the paper here abstracted detailed descriptions of the male, female, nymphal stages and egg are given.

YORKE (Warrington) & SOUTHWELL (T.). **Lappeted** ***Anoplocephala*** **in Horses.**—*Ann. Trop. Med. & Parasit.* 1921. Sept. 30. Vol. 15. No. 3. pp. 249–264. With 11 text figs. and 1 plate.

In this paper the authors give descriptions of two Anoplocephala: the first found in zebra in North-eastern Rhodesia, and the second in horses in England and elsewhere. Neither is a new discovery. The parasites found in the zebra are identified with *Taenia zebrae*, Collin, 1891. The object of the re-description of the parasite found in the horse is to draw attention to the variations which may occur.

The following technique was employed in the examinations: the parasites were stained entire for several days in acetic-acid-alum carmine, and washed, and taken through alcohols to clove oil. When clear, segments were detached singly and mounted serially with the anterior surface upwards. The microtome was resorted to for the anterior portions as it was found impossible to manipulate the minute segments. Horizontal sections were also examined.

I. Anoplocephala rhodesiensis.

	Long.	*Broad.*	*Thick.*
Largest specimen	114 mm.	22 mm.	3·25 mm.
Smallest specimen	14 ,,	4·25 ,,	1·75 ,,
Average size	90 ,,	20 ,,	3 ,,

Specimens under 30 mm. were immature. In an average specimen there were about 250 segments.

Head.—Cuboid, about 2 mm. long by 3·25 mm. broad. Suckers placed facing directly forwards and separated by grooves.

The lappets are about 1·25 mm. long by 1·75 mm. broad, and in some specimens they were globular and filled with fluid.

The general shape of the worm varies with individuals, but generally the greatest breadth is about 1 cm. from the posterior end.

The segments are very shallow and imbricated.

Internal anatomy.—Longitudinal and tranverse muscles are strongly developed; dorso-ventral muscle is less marked.

There are three longitudinal nerves on either side, the median being by far the larger.

The water vascular system is well developed and comprises a large ventral vessel and a smaller dorsal one.

At least the whole of the posterior half of the worm is sterile and shows no traces of genitalia. As no evidence could be found that segments had been shed it appears to be probable that the worm is passed entire with the faeces.

Testes are found in the fifth to twenty-fifth segments. At their maximum they measure 50 to 90μ by 30 to 70μ, and they usually lie three or four deep in the dorso-ventral direction in the medullary parenchyma.

The vas deferens after running laterally from the testes for a short distance, dilates into the outer seminal vesicle. It then narrows, and enters the cirrus pouch, where it again dilates to form the inner seminal vesicle. The cirrus is long, slightly coiled, and armed with very minute spines.

The ovary first appears at about the last segment shewing testes, and is present in about ten segments. The ovary consists of a series of vertical club-shaped columns arranged two deep antero-posteriorly and measuring 170μ by 60μ.

The vagina is well developed by the sixteenth segment. From the pore, after travelling a short distance ventrally, it becomes dorsally placed and enters the large receptaculum seminis. This is roughly club-shaped with the dilated inner end bent ventrally. The genital pores are all dextral.

The vitelline glands appear at segment 7, and disappear at segment 40. They lie close to the inner end of the receptaculum seminis. The shell gland appears to lie dorsal to it. The uterus, of which the first evidence is seen about the fifteenth segment, is fully developed in the second forty segments, and contains ova. At this point it is a straight wide tube devoid of outgrowths.

Eggs.—Although sixty worms were examined no mature eggs were found. Large and small eggs were often found in the same uterus. The large, which measured about 25μ, appeared to have three envelopes, the embryo occupying the innermost completely and measuring about 11μ. The bulk of the eggs did not exceed 15μ.

All attempts to discover a pyriform body failed.

II. Anoplocephala perfoliata (Goeze, 1782). Blanchard, 1848.

This species measures 30 mm. to 45 mm. in length by about 12 mm. in breadth.

The head is almost cubical. The suckers and lappets and muscular system resemble those of *A. rhodesiensis.*

Segments number 90 to 130.

As a rule three longitudinal nerves were present on each side, in some cases the median nerve was the only one constantly present. Different segments of the same worm showed the dorsal and ventral nerves present or absent. Excretory system as in *A. rhodesiensis* but smaller.

The segments become increasingly ripe towards the posterior extremity, and only an occasional sterile segment was found here and there.

There appeared to be no doubt that segments had been shed from the posterior end. The testes appear about segment 12 and disappear at about the thirtieth.

It would appear that the testes vary markedly in the stage of development in different individuals, or individuals from different hosts. In old worms they seem to degenerate and disappear.

The outer and inner seminal vesicle did not exhibit any constant relationship to each other. The ovary is present in segments 25 to 45. In some specimens examined the ovaries had entirely disappeared.

The uterus makes its appearance as a delicate cell string about the twelfth segment, and it attains its full development only in the last few segments; there it shews numerous anterior and posterior pocketings.

Fully mature eggs were found in the last few segments only. The outer envelope was about 80μ in diameter and the embryo about 16μ. The length of the horns of the pyriform apparatus was about 18μ. As the egg matures its envelope shrinks, and its measurements are therefore valueless. In quite ripe eggs the horns of the pyriform apparatus are prolonged into very long slender filaments which eventually unite with one another.

The authors conclude that the points held by FÜHRMANN to distinguish *A. zebrae* (Führmann) from *A. perfoliata* have no specific value. In their experience the only constant points of difference between the Anoplocephala of the zebra and horse are:—

1. *A. rhodesiensis* is the more massive and has twice as many segments as *A. perfoliata.*

2. The posterior half of *A. rhodesiensis* is entirely sterile, whereas *A. perfoliata* is ripe up to its posterior extremity.

BACTERIAL DISEASES.

FLEISCHNER (E. C.), VECKI (M.), SHAW (E. B.) & MEYER (K. F.). **The Pathogenicity of *B. abortus* and *B. melitensis* for Monkeys. Studies on the Genus Brucella Nov. Gen. III.**—*Jl. Infect. Dis.* 1921. Dec. Vol 29. No. 6. pp. 663–698. With 4 charts.

In this paper are recorded a number of experiments which were designed to throw light upon certain aspects of the relationship between *B. abortus* and *B. melitensis*.

The results obtained are best given in the authors' own words.

" Following an intravenous inoculation of *B. abortus*, agglutinins develop fairly rapidly in the blood of monkeys. The animals may show an intermittent type of fever and lose weight. At post-mortem examination it is possible to recover the organisms from the spleen, lymph nodes, and liver, while even on the fourth day after the injection the blood-stream is found sterile.

" By feeding the growth of glycerol agar cultures of moderately virulent strains of *B. abortus* on carrots, bread, or apples in large and repeated doses, it is possible to obtain definite infections in a fairly large percentage of monkeys. The duration of incubation, as judged by the appearance of serum agglutinins, is always prolonged, and at least 30 to 40 days may elapse until such substances can be demonstrated. The infection can be positively proven by the isolation of *B. abortus* from the spleen, and occasionally from other tissues.

" The repeated oral administration of massive doses of highly virulent *B. abortus* cultures causes a rapid development of specific agglutinins ; by the sixteenth day the serum may be active in a dilution of 1 : 40–80. Interruption of the feeding leads to a gradual diminution of the antibodies, probably on account of the disappearance of the bacteria from the tissues. Milk of cows heavily contaminated with cultures of *B. abortus* of low virulence when fed for at least 52 days, failed to cause infections. The mere ingestion of cow's milk rich in agglutinins never led to an appearance of these substances in the serum of monkeys.

" Milk obtained from goats which had been experimentally infected with *B. abortus* of low virulence and which contained relatively few bacteria, failed to produce an infection in monkeys, even when fed for 12 to 42 days.

" By feeding repeatedly the milk of a goat that had been infected by the injection into the udder of a very virulent strain of *B. abortus* of porcine origin, it was possible to infect one monkey. *B. abortus* was isolated at necropsy from all the viscera and the heart blood.

" Serum agglutinins specific for the bacteria of the Brucella group are formed only in the presence of a definite infection. The ingestion of heat-killed, autolysed abortion bacilli is antigenically ineffective in monkeys.

" Certain strains of *B. melitensis*, which produce characteristic lesions in guinea-pigs resembling those of *B. abortus*, when injected into monkeys intravenously give rise to characteristic temperature, positive agglutination reactions, and the organisms are recoverable at the post-mortem examination from various tissues.

" One atypical *melitensis* strain, introduced via the alimentary canal, was not always pyrogenic, but it stimulated agglutinins, and the ingested bacteria persisted for at least 57 days in the spleen and mesenteric lymph nodes.

"The microscopic changes produced by a *B. melitensis* or by a severe *B. abortus* infection in the monkey resemble those of an early typhoid infection."

Summary.—"Virulent strains of *B. abortus* in sufficiently large dosage are pathogenic for monkeys.

"*B. melitensis* is far more invasive than *B. abortus.* One or two feedings of one-thousandth the amount necessary to cause an infection with *B. abortus* is sufficient in *melitensis* infection to parasitize a monkey."

RECORDS (E.) & VAWTER (L. R.). **Ictero-hemoglobinuria in Cattle.**—*Jl. Am. Vet. Med. Ass.* 1921. Nov. Vol. 60. No. 2. pp. 155-164.

This name has been proposed by the authors for a disease more commonly known as "red-water disease" in the districts where it occurs. It is widely prevalent on the Pacific Coast and in neighbouring states.

As a rule the disease does not occur as a widespread outbreak, but an occasional animal dies throughout the season.

The typical symptoms are: Sudden suspension of the normal functions and loss of appetite, arching of the back, coat dry and harsh; distressed expression, and eyes appear sunken; accelerated, shallow respiration, with an expiratory grunt; icteric membranes. As a rule the temperature at the onset is about 106°, but this drops later, and may be subnormal for some time before death.

As the disease progresses the bowels become very active, and small movements are passed which may be almost entirely composed of blood. Urination is frequent and copious, and the urine is of a deep garnet colour. The red-cell count drops to about two million and the leucocyte count rises to about 40,000. The period of illness averages about 36 hours.

Rigor mortis develops rapidly after death; the lesions associated with anaemia and jaundice are found. Petechial haemorrhages are found in the subcutis, and in some cases there is haemorrhagic oedema along the neck and shoulders. The abdomen may contain as much as two litres of blood-tinged transudate; the serous membranes show petechiae and haemorrhages. The mucous membrane of the duodenum shows desquamation and haemorrhages.

Elsewhere in the intestine the mucous membrane may show deep erosions. There is invariably thrombosis of the portal vein, with resulting infarction. The spleen is not enlarged, but its surface shows ecchymosis. The kidneys show punctate haemorrhages in the cortex.

The lesions in the thorax are parallel with those in the abdomen.

Bacteriological investigations have yielded the following results:—

Bacillus botulinus has been recovered from the liver infarcts in four cases, but not in a state of purity.

B. oedematiens and *B. histolyticus*, both mixed with other anaerobes, have been recovered from the same place in other cases. A Gram-positive diplococcus, apparently belonging to Type IV pneumococcus group, has been found in every case.

B. sporogenes has been recovered from most of the cases.

B. welchii, Type IV, has been found in every case when the methods employed have been suitable for its detection. It has been recovered from the liver infarct, portal, mesenteric and mediastinal lymph glands, spleen, and heart muscle, but it has never been recovered from the blood, but it is the only organism recovered which has possessed haemolytic properties.

It is noted that bacteriological investigations were carried out only when the animal had been dead less than four hours. Many of the organisms recovered were tested by inoculation on small animals and upon cattle, but the organism mainly concentrated upon was *B. welchii.*

Enormous doses of culture administered orally were practically without effect. Of about 30 head of young cattle inoculated intramuscularly into the thigh with 25 to 35 mil doses, all developed local oedema, and two showed marked haemoglobinuria, jaundice, and other manifestations resembling those seen in a natural case, including a marked drop in the red-cell count (to about 3,000,000).

The post-mortem lesions, while not reproducing exactly those of a natural case, approximated very closely to them. The liver infarcts were small and multiple, and the authors consider that this may be due to the difference in the method of infection.

None of the other organisms recovered proved to be pathogenic for bovines. WOOD, working in California, has had parallel results.

The fact that *B. welchii* is not found in a state of purity does not exclude it from being the possible cause of the disease. It appears to be probable that some predisposing factors make it possible for this bacillus to assume invasive properties, and to establish itself in apparently normal animals. Some of the apparently predisposing conditions are :—The disease is, as a rule, seen during the summer, but occasionally cases are observed during the winter. Most cases occur on land into which water drains and cannot escape. Maximum stagnation and concentration of the pools in such areas seem to be associated with the greatest incidence of the disease. It is exceptional to find cases out of irrigation areas on the open ranges, but they do occur when the animals are receiving hay and well water, and, as a rule, this hay comes from the type of land upon which cases of the disease occur.

An aggressin, prepared by inoculating young cattle with *B. welchii*, has been used on about 1,200 animals in most seriously affected districts. No figures are available, but the percentage of cases is said to be lower among the animals treated with the aggressin than among the untreated controls. This method of protection, if proved to be valuable, could not be practised on a large scale, owing to the small percentage of successful inoculations of cattle with *B. welchii*, this rendering the cost prohibitive.

However, as the authors point out, this question hardly arises until the etiology of the disease has been established definitely.

HADLEY (F. B.). **Results from immunizing Cattle against Abortion.**—*Jl. Am. Vet. Med. Ass.* 1921. Oct. Vol. 60 (New Series 13). No. 1. pp. 26–33.

The results obtained with 474 cows and heifers which were vaccinated and 101 controls are given in this paper. Among the controls roughly 30 per cent. aborted, while among the vaccinated animals the figure was about half that. It is to be noted, however, that 44 of the animals vaccinated were pregnant at the time of the operation. Of these 13 had not and 31 had previously aborted. The percentage of normal calvings in the latter of these groups was practically the same as the percentage obtained when cows which had previously aborted were vaccinated before being put to the bull again.

Vaccination of non-pregnant cows which had not aborted yielded a distinctly higher percentage of normal calvings than the vaccination of non-pregnant heifers, and the author states that this supports the general belief that heifers are more susceptible than cows. The German view is opposed to this, it being held that age has no influence on the rate of infection.

It is stated that the results were very variable as between different herds, although the total figures show in a marked way the value of the method. In some herds vaccination produced no change in the abortion rate, while in a very few cases the treatment appeared to be detrimental. Actual figures of these cases are not given.

The sequelae of abortion were influenced favourably.

The author compares the total percentage figures published in England and Germany with his own, and suggests that the higher percentage of failures shown by his figures is probably to be accounted for by a higher degree of virulence of the infection, and possibly also a greater susceptibility on the part of the cattle.

BRANFORD (R.) & DOYLE (T. M.). **Notes on Contagious Abortion in Pony and Donkey Mares.**—*Agricultural Research Institute, Pusa, India. Bulletin No. 121.* 1921.

Equine contagious abortion made its first appearance at the Government Cattle Farm at Hissar in 1911, and was in all probability introduced by one or more pony mares purchased in that year. The authors note that it is difficult to buy pony mares suitable for breeding Army mules from the original breeders, because of their suitability for pony breeding. The majority of the mares which are sold at fairs or by dealers come into the market either because they are shy breeders, or because they have already aborted.

Pony mares usually abort at an earlier period of gestation than donkey mares.

Symptoms.—Unless mares are far gone in pregnancy, symptoms are, as a rule, quite absent both in ponies and donkeys, nor is there visible discharge. When abortion takes place in the later stages of pregnancy some premonitory symptoms may be observed, and there may be a thin slimy greyish-white discharge. On a number of occasions an aborted foetus has been found in a yard containing twenty or more pregnant mares, and it has been impossible sometimes to discover which mare has slipped her foal. Dilatation of the os uteri after abortion of a three months foetus is not more than is normal in many brood mares.

The chocolate-coloured discharge referred to by American authors has not been observed.

Although in cases of premature birth occurring during the later stages of pregnancy the membranes may appear to be perfectly normal and the foal may be born alive, in no instance has such a foal been reared. Symptoms of joint ill supervene within a few days. The lesions in such foals indicate a generalized invasion of the body by a pus-producing organism.

The etiology of the disease has not yet been definitely established, nor has it been proved that the causal organism is the same in ponies and donkeys, but from foetuses or membranes of both species there has been isolated a short thick Gram-negative bacillus, which gives a thin white growth, showing a tendency to wrinkling on agar.

The facts observed during the outbreak in 1920 would appear to indicate that the period of incubation in donkeys is three weeks or more.

Ingestion is in all probability the method of infection.

The routine procedure of dealing with the disease is as follows :—

1. Aborting mares are isolated for six weeks. The vagina and uterus are washed out daily with a disinfectant for ten days, and then three times a week for the remainder of the period.
2. The foetus, membranes, etc, are burnt on the spot where they are found.
3. The in-contact mares are moved at once to fresh quarters and fresh grazing grounds.

The main difficulty arises from the fact that a mare may abort when grazing, and the act may never be detected, as the foetus and its membranes are devoured by vultures within a few moments.

The disease confers no valuable degree of immunity. Abortion not infrequently occurs twice, and intervals of one, two, or three years, during which the mares foal normally, may occur between successive abortions.

In the majority of cases in ponies (about 70 per cent.) abortion occurs between the third and sixth months. When abortion occurs twice the second takes place at an earlier period of gestation than the first in most instances.

In donkeys the average period of gestation at which abortion occurs is later than in mares. About 40 per cent. abort after the eighth month.

In pony mares more than 75 per cent. of those affected with abortion bred normal foals at some period during the years following the act, and rather more than 20 per cent. proved to be sterile. They were only considered sterile when repeated efforts to get them in foal, both by natural and artificial means, had failed.

As most of the cases of abortion among donkey mares occurred during 1920, it is too soon as yet to arrive at any conclusion as to the frequency with which it may cause sterility in them.

DISEASES DUE TO FILTERABLE VIRUSES.

VAN SACEGHEM (R.). **L'anaphylaxie dans l'hyperimmunisation des Bovidés contre la peste bovine.** [Anaphylaxis in the Hyperimmunization of Cattle against Rinderpest.]—*C.R. Soc. Biol.* 1921. Dec. 10. Vol. 85. No. 36. pp. 1105–1106.

Direct intravenous transfusion of blood can be used with safety for hyperimmunizing immune cattle against rinderpest, provided that the animals have been immunized several (six) months previously. Serious accidents are liable to occur if the immunization has been effected less than six months before.

Direct subcutaneous transfusion is not followed by untoward consequences. The symptoms of anaphylaxis can be immediately arrested by intravenous injections of 5–10 cc. of sulphuric ether.

VAN SACEGHEM (R.). **La vaccination contre la peste bovine.** [Vaccination against Rinderpest.]—*C.R. Soc. Biol.* 1921. Nov. 8. Vol. 85. No. 32. pp. 878–879.

The bulk of this short paper is devoted to an account of the objections that may be raised to the "simultaneous" method of inoculating against rinderpest.

[The author's experience would not appear to agree with that of others who have employed the method on a large scale.—A. L. S.]

The author has devised a method which has proved successful in his hands, and which he terms the " deferred method," as opposed to the " simultaneous method."

It is as follows :—Very small doses of virus (0·1 cc. for Ruanda cattle) are given, and on the second day of the febrile reaction 50 cc. of serum are injected into the jugular vein.

The two great objections to the old method are avoided. There is no longer any danger of neutralizing the virus before it can cause any infection, as the disease is allowed to get a start. The serum is injected when the animal begins to react, and thus renders good service at the right time, and cannot exert any paralysing action on the defences.

ROBERTS (G. A.). **Rinderpest (Peste Bovina) in Brazil.**—*Jl. Amer. Vet. Med. Assoc.* 1921. Nov. Vol. 60. No. 2. pp. 177–185.

This paper contains an account of what appears to be the first official record of the occurrence of rinderpest in Brazil.

The source of the infection has not been traced definitely, but it has been suggested by some that the Indian zebus, which brought the disease into Holland, were also responsible for its introduction into South America.

The first deaths occurred among the draught oxen belonging to a trading company. Shortly afterwards animals belonging to farmers in the locality began to die, these animals having been used for draught work to and from the factory.

Anthrax, black-leg, and haemorrhagic septicaemia were all excluded as the cause of the deaths either at once or after investigation.

Further investigations, involving the inoculation of cattle and goats and small animals, ruled out the bacterial diseases definitely, and established rinderpest as the cause of the deaths.

The disease then broke out among dairy herds, and in one instance an entire herd of 28 head was wiped out in 23 days. The disease did not spread to sheep, but these and goats died from it when they were put with infected cattle.

The period of incubation in natural cases were three to five days, and after inoculation two to four days. A rise of temperature up to 106° or more spread over a period of two to four days, followed by a drop to subnormal in three days or less, was the typical temperature reaction.

Lachrymation and nasal discharge were observed in about 50 per cent. of cases. Respirations were accelerated, and frequently expiration was accompanied by groaning or grunting. The mouth lesions ranged from small scattered patches—with adherent lymph of a yellowish-grey colour, which on detachment left a small erosion—to generalized stomatitis. Diarrhoea on the second or third day after the rise of temperature was a very constant symptom. The colour was greenish-yellow, usually streaked with blood, and the odour was very offensive. The lesions found at the post-mortem were typical of rinderpest.

The disease was known to exist in an area with a radius of 50 miles round São Paulo. A quarantine zone, five miles wide, was established round this area, and movements of animals were prohibited. Within the radius where cattle grazed on unfenced land compensation was paid at the rate of 50 dollars a head for cattle slaughtered and 25 dollars for cattle dying.

When the disease was detected in any premises the owner was advised to slaughter. If he refused he was rigidly quarantined.

The total number of cattle within the area was about 30,000, and of these 600 died of rinderpest and 1,000 were slaughtered.

The last official report of a case of the disease was made on May 23, 1921, and restrictions were removed in August.

It is noted that the indemnity represented about a quarter of the value of the animals.

CURASSON (M. G.) **Notes sur la Peste Bovine en Afrique-Occidentale française et en Pologne.** [Notes on Cattle Plague in French West Africa and in Poland.]—*Rev. Gen. Méd. Vét.* 1921. Oct. 15. Vol. 30. No. 358. pp. 569–59.

This paper represents the results of observations made by the author during a period of four years in French West Africa and during a period recently spent in Poland.

In the author's opinion very considerable variations occur in animals inoculated with virulent blood according to the phase of the disease at which the blood is taken. The classical sequence of symptoms is obtained when the blood is withdrawn from an infected animal at the initial rise of temperature and before lesions develop.

Attention is drawn to what may be termed abnormal reactions occurring in animals inoculated with virulent blood, due to varying degrees of resistance.

No success has been obtained in attempts to demonstrate the presence of antibodies in the rinderpest blood—complement fixation, agglutination, and precipitin tests have all yielded negative results. It appears to be very uncertain whether the leucocyte formula undergoes any alteration during the course of the disease or not, save that in some instances there is a slight increase in the total number during the first few days, and then a slow decrease, which persists while the blood remains virulent.

In four cases the progeny of hyperimmunized animals proved refractory to the inoculation of 5 cc. of virulent blood when injected at ages ranging from 1 to 11 days. These calves were with foster-mothers which had only a serum immunity.

A small number of experiments have been carried out by the author with a view to ascertaining the minimum infecting dose of virulent blood. Doses less than 10 cmm. were of uncertain infectivity; but were always successful in one or more instances.

In two experiments recorded by the author bile was found to be devoid of immunizing power, or at least of the power of conferring any useful degree of immunity. No details are given regarding the bile used. These experiments were carried out in Poland, and the author states that the Polish veterinary surgeons who had had experience of the bile method had formed very unfavourable opinions of it.

The subcutaneous inoculation of animals at the second day of the thermal reaction with 20 cc. to 50 cc. of their own blood prolonged the febrile reaction to a total of five or six days. This point is said to be of value in large serum-making stations, where one is quite likely, in spite of careful arrangement, to have too many virus producers "ready" on any particular day, as it permits of their being kept over for a day or two.

Some points are given in regard to the discussed question of the seat of the virus in the blood.

According to the author, simple laking of the blood with more than five volumes of distilled water is sufficient to destroy the virus. He holds that this is due to the destruction of the red corpuscles, because similar dilution of blood with physiological salt solution is not followed by any destruction of virus. In his view, lower dilutions fail to destroy the virus because some of the red cells escape lysis.

Aqueous humour, urine, and gland juice may all be diluted with distilled water (dilution specifically mentioned, 1 in 20) without destruction of the virus contained in them. The author therefore thinks that in these substances the virus is not attached to any formed elements.

Urine was found to become virulent on the day after the first rise of temperature, and was still infective on the ninth day. It is not stated whether it became avirulent after that.

The blood of two virus producers which recovered was found to be infective on the sixteenth and nineteenth day of the disease. Their urine was not found to be infective. There is nothing to indicate whether the urine was non-infective throughout, or on the days referred to only.

A number of experiments were carried out with a view to testing the sensitizing power of anti-cattle-plague serum. The virus was taken at the initial rise of temperature, and the serum used was the routine product of the laboratory. These were mixed in proportions ranging from equal parts to 1 in 50, and placed in an incubator for periods from 15 minutes to three hours. Quantities representing $\frac{1}{2}$ cc. to 1 cc. of the undiluted virus were then used for the inoculation of animals.

The virus was never destroyed after periods of less than two hours of contact in any dilution. After that the degree of dilution played a part, as virus diluted with ten volumes of serum was destroyed within two and a half hours, while a mixture in the proportion of 1 to 2 proved to have retained its virulence after the same length of time. The author was unable to find any evidence in support of NICOLLE & ADIL BEY's statement that anti-cattle-plague serum contains a haemolysin.

The milk of hyperimmunized serum-producing cows was found to possess protective powers, but the dose required was about ten times that required of serum to produce the same degree of immunity. Whey was less active than whole milk. Milk retained its protective properties for a period of three weeks (not tested further).

The author suggests the possibility of utilizing the milk of recovered animals for protective purposes in the absence of serum.

The author leaves the question as to the possibility of recovered animals acting as carriers unsettled, but refers to a case in which vaginal discharge from a cow which had " recovered " at least a month previously was in all probability the starting-point of an outbreak in the herd into which she was introduced.

ODERMATT. **Beobachtungen über die Blutimpfungen bei der Maul- und Klauenseuche in der Seuchencampagne 1920 im Kanton Luzern.** [Blood Inoculations during the Outbreak of Foot-and-Mouth Disease in the Lucerne Canton during 1920.]—*Schweiz. Arch. f. Tierheilk.* 1921. Sept. Vol. 63. No. 9. pp. 347–365.

Having summarized the severe outbreaks of foot-and-mouth disease which occurred in Switzerland during the period 1918 to 1920, the author gives a survey of the literature dealing with attempts that have been made to deal with the disease by inoculation with various materials derived from infected or from recovered animals.

He proceeds to detail the arrangements made in Lucerne for the provision of fresh blood from recovered animals for inoculation of infected herds in the field. The animals supplying the blood were bled to death, and the carcases were inspected for evidence of contagious disease. The blood from diseased animals was destroyed.

When an outbreak occurred the freshly obtained defibrinated blood (with carbolic added) was despatched to the veterinary surgeon in charge. An examination of all the animals was first made, and those showing evidence of infection were not injected. Any healthy-looking animal having a febrile temperature was considered as infected and also excluded. The blood was first warmed, and then injected either on both sides of the neck or behind both shoulders, the dose being 150 cc. on each side.

Defibrinated blood was used in preference to serum, because of the greater ease of preparation, the large quantity obtained, and the greater speed with which the fresh material could be placed in the hands of those applying for it.

In some cases sodium citrate or oxalate was used to prevent clotting. Three grams per litre were found to be sufficient, and the salt in this amount produced no harmful effects. The author goes into the question of the factors involved in the varying rapidity with which blood corpuscles sink in the plasma or serum of different animals, and concludes that the rapidity depends upon agglutination of the cells.

Statistics collected showed that the mortality among inoculated animals was 2·2 per cent. (taken on a total of over 8,000), while among uninoculated animals the mortality was 23·05 per cent.

The author also gives figures showing the effect of the inoculations upon the milk production. In nearly 90 per cent. of herds the milk production was favourably influenced by the inoculations.

Accidents as a result of inoculation were rare, and during 1920 only six animals had to be killed as a result of abscess formation, and the percentage on the whole of the animals inoculated after the establishment of the central installation for the provision of blood was 3·47.

Sequelae, such as abortion, disease of the claws, agalaxia, wasting, etc., were not entirely prevented by the inoculation, but they were very markedly reduced. In addition to the fresh blood prepared at Lucerne the so-called Ma-Kla-Serum of the Berne Institute was employed in certain cases. The mortality among the 425 animals inoculated with this was 2·11 per cent., while uninoculated animals on the same premises died in the proportion of 6·9 per cent.

Inoculations carried out on the same premises with the two products for comparative purposes always yielded results in favour of the blood, but this was possibly due to the fact that the dose of the Berne serum was only 200 cc.

The cost of inoculating a large animal was 20 francs.

Tarantino (B.). **La peste equina in Eritrea.** [Horse Sickness in Eritrea.]—*La Clin. Veterinaria.* 1921. Aug. 31. Vol. 44. No. 16. pp. 441–446.

In this short paper the author describes briefly the clinical characters and lesions of the disease, and refers to the efforts that have been made to prepare protective agents. The bulk of the paper is taken up by a detailed statement of the occurrence of the disease in the different districts.

MISCELLANEOUS.

POLIDORI (V.). **Préparation simple d'une éosinate de bleu de méthylène pour colorations hématologiques.** [A Simple Method of preparing Eosinate of Methylene Blue for Staining Blood Films.]—*Bull. Soc. Méd.-Chirurg. de l'Indochine.* 1921. July. Vol. 12. No. 1. pp. 87–89.

1. A concentrated solution of Borrel's blue.
2. A 1 per cent. solution of Höchst medicinal methylene blue in 90 cc. of 90 per cent. alcohol and 10 cc. of methyl alcohol.
3. A 1 per cent. solution of eosin in alcohol.

For fixation a mixture of equal parts of the three solutions is allowed to act for three minutes.

The staining is then effected by a simple dilution of the Borrel blue solution, 1·5 per cent., and it would appear from the description given that the slide, with its 15 drops of fixative still on it, is placed face upwards in a small dish containing 10 cc. of the dilute Borrel blue solution the dish being shaken for about half a minute to ensure complete mixing of the fixative and stain. The slide is then turned face downwards and left for 10–15 minutes. Wash in water. A pink sediment which may form on the slide is removed by a few drops of 90 per cent. alcohol acting for a very short time.

CLAREMONT (C. L.). **The Ministry's Research (Rat) Laboratory.**—*Jl. Ministry of Agric.* 1921. Nov. Vol. 28. No. 8. pp. 712–718.

Hunting and trapping are not satisfactory means of reducing the number of rats in any infested places, and do not now play any considerable part in the measures adopted for their destruction.

The "virus" method is open to certain objections, of which the chief are: (1) varying susceptibility of the rats to the virus; (2) immunization by sublethal doses; (3) the risk of the virus used being or becoming pathogenic for other animals or even for human beings; (4) doubt as to the disease being to any large extent transmitted from rat to rat, the disease not being contagious, but transmitted only by ingestion of the virus. The possibility is hinted at that these objections may be overcome and that bacteriological methods of destruction may come into use. Poisoning by various means remains the most valuable method of eliminating rats, but it must be borne in mind that the available food supply and shelter are important factors, and that "proofing" must be carried out to the utmost possible limits if poisoning is to be successful.

The work of the Rat Research Laboratory is carried out in one of the old blocks of the Mount Pleasant Post Office, and a small factory is run in conjunction with it.

The Red Squill (*Scilla maritima*) has been the subject of extensive investigation. This bulb has been known to be poisonous for rats for a very long time, but little has been done regarding its chemistry. If the raw bulb be chopped up it soon loses its toxicity. Cooking the bait increases its keeping properties. Powdered dried bulbs are toxic, but the conditions necessary for maintaining the maximum strength are not known. Of such powder 1 gr. or 2 gr. are the minimum lethal dose for a medium-sized rat. The toxic principle has not been isolated with certainty, and nothing is known regarding its toxicity for domesticated animals. Experiments at the laboratory have shown that rats eat about one-tenth of their body weight per day, a bait should therefore be from 30 gr. to 60 gr., representing one-tenth of the day's food supply, and each bait should contain a lethal dose. Baits should be prepared so that they are ready for use in biscuit or tablet form, and, what is the most important point of all, they must be attractive to the rat. Oatmeal and fat are suitable vehicles. Biscuits may be made by mixing the poison with flour and working it into a dough, which is then baked. Old cheese, fish meal, sugar, or some such material should be added as a flavouring.

In England it has been found that rats prefer a bait which is flavoured with some substance different in nature from that occurring in the principal forms of food obtained in the particular place. It is instanced that in a grocer's establishment fish might be used with advantage. It is said that in India it has been found that a bait similar to the usual diet is most successful.

The following figures are given for the quantities of the different poisons which should be contained in the baits :—

Arsenic, 5 per cent	about	20	gr.
Barium carbonate, 25 per cent.	,,	30	,,
Squill bulbs, 20 per cent.	,,	50	,,
Squill powder, 20 per cent.	,,	25	,,

Bishopp (F. C.) & Laake (E. W.). **Dispersion of Flies by Flight.**—*Jl. Agric. Res.* 1921. Aug. 15. Vol. 21. No. 10. pp. 729–766. With 3 figs and 11 tables.

In this paper the authors describe experiments carried out under rural and urban conditions with a view to discovering the distance travelled by flies of a number of species.

Musca domestica, Chrysomyia macellaria, and *Phormia regina* were the principal species used, but other species were used in smaller numbers—numbers too small to permit of the founding of sound conclusions.

Details are given of the manner in which the flies were trapped, marked (usually with powdered chalk), liberated, and recaptured and identified. The maximum distances travelled by the three species given above were 13·14 miles, 15·1 miles, and 10·9 miles respectively. It is estimated that about a quarter of a million flies were utilized in the tests. Flies dispersed in all directions from the points of liberation. The desire for food and the seeking of places suitable for oviposition are among the strongest motives inducing dispersion, but it seemed that the passing over of suitable places indicated real migratory tendencies. Owing to changing wind conditions no exact relationship could be established between direction of wind and direction of dispersion. It would seem that moderate force of wind does not influence direction of dispersion.

Chrysomyia macellaria travelled eight miles in less than 24 hours, and 10 miles in less than 48. *Phormia regina* travelled 11 miles in less than 48 hours, while *Musca domestica* was recovered over six miles away in under 24 hours.

The authors think that the limits of dispersion were not reached during the tests.

REPORT.

ASSAM. **Report of the Civil Veterinary Department, Assam, for the Year 1920–21.**—1921. Shillong. Assam Secretariat Printing Office. pp. 1–17. Price 8 *as.*, or 1*s.*

This report contains details of the work of various branches of the department under the usual headings, and, as an appendix, a report on the veterinary administration of Manipur State. The Superintendent of the C.V.D., Assam, has been appointed Veterinary Adviser to the Manipur Durbar. A portion of the tenth paragraph of the covering letter of the Director of Land Records and Agriculture is worded as follows:—"The resignation of four assistants during the year is regrettable: unfortunately my experience of the department, extending over nine years, shows that no one, on the average, takes up veterinary work except as a last resort. Consequently the general standard of education of the assistants is usually below the matriculation standard. The result is often miserably bad diagnosis and an entire absence of interest in professional work: in fact posts seem to have been accepted mainly as a means of providing an income in uncomfortable and uncongenial circumstances, which should be avoided whenever possible. The ultimate result is that when work is insisted upon, resignation is the only alternative to dismissal."

BOOK REVIEW.

KNUTH (P.) & DU TOIT (P. J.). **Tropenkrankheiten der Haustiere. Handbuch der Tropenkrankheiten, herausgegeben von Carl Mense. Zweite Auflage, Sechster Band.** [Tropical Diseases of the Domesticated Animals. MENSE's Handbook of Tropical Diseases. 2nd Edition. Vol. VI.]—1921. Leipzig. Johann Ambrosius Barth. pp. 1–889. With 143 text figs. and 4 coloured plates. [Price M. 240—bound, M. 264.]

It is stated in the preface of this volume that the manual of which it forms a part is intended for medical men, and certainly it will be of more value to them than to veterinary surgeons, who will not, in all probability, possess the whole series. In other words, the book as a manual of Tropical Diseases of Domesticated Animals is incomplete. The authors are conscious of this defect, as they draw special attention to at least one respect in which this incompleteness is evident. Certain factors in tropical diseases are common to the human subject and to animals and to avoid repetition these factors are dealt with once only—in the volumes dealing with human diseases. It is admitted by the authors that this is unsatisfactory, and it is the more so in that the veterinary aspect is not apparently taken into consideration. It is more particularly in connection with the trypanosomiases that the lacunae in the information given are obvious. A general survey of transmission and the transmitting agents is lacking. Such a defect as this renders the volume unsatisfactory from the veterinary point of view and greatly reduces its value as a separate entity.

The authors have evidently encountered the difficulty of deciding what is to be considered as a "tropical disease," and what diseases occurring in the tropics are to be dealt with. The line of demarcation between diseases occurring in the tropics and in temperate climates is rapidly becoming blurred, and the list of diseases of animals which are not found elsewhere than in the tropics is becoming shorter. The authors have, therefore, confined themselves to the description of diseases which they consider to be characteristic of the tropics, and have omitted those which, while playing an important part there, have a distribution extending beyond tropical and sub-tropical countries. It is perhaps a difficult question to decide exactly what information a "handbook or manual" should contain. In any case the volume under review is defective by reason of its incompleteness from the point of view of both student and worker whether in temperate climates or in the tropics. This criticism is anticipated by the authors in their preface and they point out that to deal adequately with the diseases occurring in the tropics would require not one, but several volumes. This is self-evident and it indicates the inadvisability of trying to deal in a single volume with so vast a subject. There are five in this manual dealing with the diseases of man in tropical countries.

Probably the most valuable parts of the book are the full lists of references, which are said to be as complete as possible up to the end of 1918. No doubt owing to the necessity of extreme compression the text in many places gives one the impression of being merely a succession of abstracted abstracts strung together, and thus lucidity is to a large extent sacrificed.

The book is divided into six sections dealing with (1) Diseases caused by protozoa; (2) Diseases caused by ultravisible viruses, (3) Diseases caused by bacteria; (4) Diseases due to saccharomycetes; (5) Worm and insect diseases; (6) Diseases due to poisonous plants; and (7) Diseases of which the etiology is not known.

Reference has already been made to what must be considered an important defect in the description of the trypanosome diseases. The general question of identification of species and classification is considered at some length. Each method which has been suggested for this purpose is briefly considered and finally a classification is drawn up, based largely upon the development of the trypanosomes in the transmitting flies, but including groups which are differentiated upon other grounds such as morphology, mechanical transmission, absence of intermediate host, etc. Some of the groups are admittedly very closely allied to each other and it is realised that many objections may be raised to the classification.

In their account of the diagnosis of dourine the authors state that the symptoms of the disease are so characteristic that a mistake can scarcely be made if a diagnosis is based upon the clinical characters. It is, however, under the same heading that they consider the various serological methods of diagnosis which have been introduced or suggested. The difficulty of demonstrating the trypanosome is given as the reason for the investigation of serological methods of diagnosis, but it appears that the necessity for finding a laboratory diagnosis arose from the fact that infected animals may survive for many months without showing any evidence of infection or giving any cause for suspicion that they are infected. In breeding districts, therefore, it is of the utmost importance that a method of detecting latent disease should be perfected.

It is to be regretted that the authors have not given in tabular form their views regarding the classification of the protozoa, as they do not follow international rules of nomenclature, and they do not appear to be consistent. On page 288 Babesia is given as a sub-genus (Untergattung) of Piroplasma, and on page 292 it is stated that although the term Babesia has priority in their classification, *Babesia bigemina* belongs to the subgenus (Untergattung) Piroplasma.

Valuable space is lost in some cases by introducing information out of its proper place, and this criticism refers particularly to the "definitions" with which each description of a disease begins. For example (p. 523), the "definition" of bovine coccidiosis contains information as to its seasonal distribution, the age at which animals are attacked, and its mortality, all of which are again referred to. A further instance of waste of space is to be found on the same page, where reference is made in four places to the fact that the disease was first described as occurring in Switzerland, and in three of these instances the author of the original description is named. As already noted the authors state that exigencies of space have compelled them to confine themselves to descriptions of diseases which are characteristic of the tropics, yet one finds a description of "blackhead" in turkeys which runs to six pages, and the distribution of the disease is given as North America, France, Germany, South Africa and Australia.

The only reference to haemorrhagic septicaemia in the whole volume is contained in four lines, where it is mentioned in the differential diagnosis of rinderpest.

Possibly the authors' statement that the volume is up to date to the end of 1918 explains the fact that pre-war names are retained throughout the volume for certain areas in East and South West Africa which have since been re-named.

A. Leslie Sheather.

TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY BULLETIN.

VOL. 10.] 1922. [No. 2.

DISEASES DUE TO PROTOZOAN PARASITES.

CURASSON (G.). **Traitement des trypanosomiases du cheval en Afrique occidentale française.** [The Treatment of Equine Trypanosomiases in French West Africa.]—*Rec. Méd. Vét.* 1921. Dec. 15. Vol. 97. No. 23. pp. 689–694.

The author draws attention to the great similarity of the symptoms in cases of equine trypanosomiasis caused by different organisms, as, for example, chronic cases due to *T. pecaudi* and *T. dimorphon,* and expresses the view that in treating equine cases of trypanosomiasis the more important point to keep in mind is the nature of the infection, the causal agent being of less importance. Indications are given of the different forms of treatment that have been adopted, and the trypanosomiases are classed as acute, sub-acute and chronic.

A single intravenous injection of 2 gm. of galyl usually produces a remission of temperature, but a second rather smaller dose may be necessary on the following day. In no case should more than three doses be given.

Emetic and atoxyl.—The important point in connection with orpiment used in conjunction with emetic or atoxyl is to be certain of its purity and that it has not undergone decomposition, as it is likely to do. It is not rapid in action, and at the best it is only valuable for prolonging the effect of an injection of emetic or atoxyl. In severe cases the results are less constant than those obtained with galyl.

Toluidine blue has been used on about a score of cases, but relapses have occurred promptly.

Salicylate of soda and acetanilide are without effect. Quinine may be a valuable adjuvant to galyl or atoxyl as a febrifuge. Its injection is sometimes followed by suppuration. It was used in conjunction with antipyrine. A word of warning is uttered against the intravenous injection of this solution, as antipyrine causes coagulation of the blood. In sub-acute cases the treatment need not be so energetic and the indications favour combined methods, such as emetic-orpiment or atoxyl-orpiment, but in any case it is advisable to give a first injection which will clear the circulation, such as a gramme and a half of galyl. A careful watch should be kept and the galyl repeated if necessary.

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The author had five recoveries out of six cases of mixed *T. pecaudi* and *T. dimorphon* infection, by combining or rather by using alternately emetic and picric acid, the former given intravenously and the latter by the mouth in conjunction with opium.

In cases of a chronic nature attention to diet is more important than treatment by drugs, and complete restoration of condition may be brought about by special feeding alone, but a course of drug treatment hastens recovery. Two or three injections of atoxyl should be given to begin with, to be followed by arsenious acide in conjunction with strychnine. Arsenic in the form of arrhenal is said to give the best results.

i. ADLER (S.). **The Trypanocidal Effect of Phenylglycine Amido Arsenate of Sodium on *T. brucei* in Rats and *T. rhodesiense* in Mice.**—*Ann. Trop. Med. & Parasit.* 1921. Dec. 30. Vol. 15. No. 4. pp. 427–432.

ii. ADLER (S.). **Note on Bismuth as a Trypanocide.**—*Ibid.* p. 433.

i. The drug, a white amorphous powder, is readily soluble in distilled water, and yields a clear colourless solution. On standing it becomes yellow, and sterilizing hastens the discoloration.

Freshly prepared 5 and 10 per cent. solutions were used by intraperitoneal inoculation to ascertain the M.L.D. No toxic effects were produced until the dose reached 1·2 gm. per kilo.

On standing in solution the drug becomes increasingly toxic for a time. When the solution had acquired a deep yellow tint (eleven days) the toxicity had apparently diminished.

For rats infected with *T. brucei* the minimum curative dose was found to be 0·7 gm. per kilo.

In vitro the drug has no effect upon trypanosomes, nor has the blood of treated animals 24 hours after becoming trypanosome-free.

The drug has no curative effect upon mice infected with *T. rhodesiense*.

ii. Soluble bismuth sodium tartrate was tried in solutions of various strengths with *T. rhodesiense* and *T. brucei* (nagana ferox).

The M.L.D. for healthy mice was ·047 gm. of bismuth, and for healthy guinea-pigs ·062 gm. per kilo.

In no instance was any cure effected.

NAVARRO MARTIN (Augusto). **Sur l'emploi de l'aminophénolarsinate de soude dans le traitement des Trypanosomiases.** [The Treatment of Trypanosomiasis with Aminophenylarsenate of Soda.]—*Ann. Inst. Pasteur.* 1922. Jan. Vol. 36. No. 1. pp. 38–45.

Oxyaminophenylarsenic acid (which the author calls "189") has a marked trypanocidal effect. Its therapeutic coefficient $\left(\frac{\text{curative dose}}{\text{tolerated dose}}\right)$ is higher, at least for *T. rhodesiense* and *brucei*, than that of any other arsenical compound known. It is at least one-fifth. Nervous symptoms are only produced when five or six times the curative dose is given.

The monosodium salt, when diluted 1 in 6 to 1 in 13, may be injected subcutaneously without producing any pain or swelling.

YORKE (Warrington). **The Treatment of a Case of Rhodesian Sleeping Sickness by the Preparation known as "Bayer 205."**—*Ann. Trop. Med. & Parasit.* 1921. Dec. Vol. 15. No. 4. pp. 479–482.

The patient was taken ill in September, 1920, and from that date until early in July, 1921, he was treated with various arsenic and antimony preparations without success. By this time he was in a very low condition and the case seemed hopeless.

Treatment was begun with 0·5 gm. of "Bayer 205" in 5 per cent. solution intravenously, and the fever subsided very promptly. The following day 1 gm. in 10 per cent. solution was given, and repeated on the following day. After an interval of seven days—the blood remaining free from trypanosomes—the dose of 1 gm. was repeated. No further treatment was given, and the patient appeared to make a complete recovery. His blood remained free of parasites during a period of observation of four months.

VAN SACEGHEM (René). **Le Pétrole dans le Traitement de la Fièvre récurrente et de la Trypanosomiase.** [Petroleum in the Treatment of Relapsing Fever and Trypanosomiasis.]—*Bull. Agric. Congo belge.* Sept. 1921. Vol. 12. No. 3. pp. 493–494.

The author states that a large spoonful of petroleum taken *per os* night and morning for four consecutive days has given a large number of successes among cases of relapsing fever in natives.

The treatment is useless in animal trypanosomiases.

NATTAN-LARRIER (L.). **Infections à Trypanosomes et voies de pénétration des virus.** [Trypanosome Infections and Paths of Entry of the Viruses.]—*Bull. Soc. Path. Exot.* 1921. Nov. Vol. 14. No. 9. pp. 537–542. With 2 tables.

The author has carried out some experiments regarding the course of the infection in animals inoculated in different ways with *T. equiperdum* and *Schizotrypanum cruzi.*

Mice inoculated with *T. equiperdum* intraperitoneally shewed trypanosomes after 24 hours, and died 3–5 days later. Subcutaneous inoculation of the same virus in the same dose was followed by a period of incubation of from 48–96 hours, but the period of infection was from 2–4 days.

Trypanosoma equiperdum was found to be capable of penetrating the conjunctiva in 20 per cent. of cases, and the buccal and rectal mucous membranes in 33 per cent. of cases. On the other hand when infective material was spread over an area of skin devoid of hair infection took place without fail. The period of incubation in the case of the latter method of infection was from 7–8 days. Infection *via* the cornea was followed by a period of incubation of 9 days, rectal infection by one of 10 days, and ingestion by 14 days. After intraperitoneal inoculation the period of incubation was 1–2 days. The period of illness after intraperitoneal inoculation was 14 [? 4] days, but only about half that after the other methods of infection.

ACKERMANN (J.). **Untersuchungsergebnisse über Beschälseucheverdacht in Meiringen (Kt. Bern).** [Investigation of Suspected Cases of Dourine at Meiringen, Bern Canton.]—*Schweiz. Arch. f. Tierheilk.* 1922. Jan. Vol. 64. No. 1. pp. 13–22.

A stallion developed symptoms which very closely resembled those of dourine in April, 1921, and similar symptoms were shown by a mare covered by that animal. A very thorough investigation was carried out, but no evidence could be obtained that the animals were actually the subject of dourine.

YAKIMOFF (W. L.) & WASSILEWSKY (W. J.). **L'identification du Trypanosome des chameaux du Turkestan et de l'Oural.** [The Identity of the Camel Trypanosome in Turkestan and Ural.]—*Bull. Soc. Path. Exot.* Dec. 1921. Vol. 14. No. 10. pp. 637–638.

A sheep was infected with the camel trypanosome from Ural, and subsequently guinea-pigs were infected from the sheep. A mixture of serum from the sheep, and trypanosomes from the guinea-pigs was inoculated into three mice. A fourth mouse received trypanosomes only. None of the three receiving the mixture became infected. The control became affected. The sheep was therefore immune to the Ural trypanosome.

Using serum from the same sheep a similar experiment was carried out with camel trypanosomes from Bokhara. The result was the same. Subsequently the sheep was inoculated with trypanosomes from Turkestan. It failed to become infected and its blood did not infect a dog inoculated with it. The camel trypanosomes of Turkestan and Ural are therefore identical.

YAKIMOFF (W. L.). **À propos de l'identification du Trypanosome des chameaux du Turkestan russe.** [The Identification of the Camel Trypanosome in Russian Turkestan.]—*Bull. Soc. Path. Exot.* 1921. Dec. Vol. 14. No. 10. pp. 638–640.

The author refers to some experiments reported in Vol. 78 of the *Comptes Rendus de la Société de Biologie* in 1915, from which the following conclusions were drawn :—

1. The trypanosomes of Russian and Algerian dourine are identical.
2. The trypanosomes of donkeys in Bokhara and of camels in Russian Turkestan (of Bokhara and Samarkande origin) are identical.
3. The trypanosome of Russian dourine is not identical with the trypanosomes of donkeys and camels in Bokhara, nor with *T. brucei*.

In the present note the author records some experiments carried out by MESNIL, on his behalf, with a view to ascertaining whether the Turkestan camel trypanosome is identical with other known camel trypanosomes (*T. evansi* and *T. soudanense*).

Yakimoff sent some of the serum obtained from the sheep immunized against the camel trypanosome for the immunity tests (see abstr. above).

The sheep serum proved to be ineffective against *T. evansi* (Mauritius strain). When tested with *T. soudanense* the results indicated, in MESNIL's opinion, that there were certain resemblances between *T. soudanense* and the Bokhara trypanosome. Yakimoff believes that they are different species, because the symptoms caused in camels are not the same.

He proposes the name of *T. Ninae Kohl-Yakimov* for the Turkestan parasite.

FRANCHINI (G.). **Trypanosome de la chauve-souris en Italie. Formes viscérales et stades de développement chez un Acarien gamaside, le *Leiognathus laverani*, n. sp.** [A Trypanosome of the Bat in Italy. Visceral Forms and Developmental Phases in a Gamasid, *Leiognathus laverani*, n. sp.]—*Bull. Soc. Path. Exot.* 1921. Nov. Vol. 14. No. 9. pp. 542–546. With 2 text figs.

The trypanosome was found to be scantily present in the blood of 30 specimens of *Vesperugo pipistrellus* out of 100 caught. The parasite is small, and in stained smears is often ring-shaped (une forme annulaire). The round centrosome is quite close to the posterior end and the large oval nucleus towards the anterior end. The undulating membrane is small and shows few folds. The free part of the flagellum is sometimes very long. There appeared to be slender and stumpy forms. The range of measurements is: Length, 8·5 to 10μ; width, 1·5μ; free flagellum, 6–10μ.

The principal lesions were enlargements of the spleen and testicles, but trypanosomes were never found in the latter. Leishmaniform parasites were found in smears from the liver and lungs of three of the bats. Smears were examined from the liver, spleen, lungs, ovaries, testicles and intestine.

CHATTON and COURRIER have described the presence of multiplication forms of a trypanosome in many parts of the body of a bat of the same species captured in Alsace.

More than 50 smears, made from *Leiognathus laverani* caught on the bats, were examined for developmental forms, and in a third of the specimens examined fresh, crithidial forms and young trypanosomes in rosettes were found. Occasionally adult trypanosomes like those found in the blood were seen.

In smears from the alimentary canal of two of the ecto-parasites leishmaniform parasites and herpetomonads were found.

CAUCHEMEZ (L.). **Fréquence de la Coccidie du porc (*Eimeria brumpti*, n. sp.) en France.** [The Frequence of Coccidiosis of the Pig (*Eimeria brumpti*, n. sp.) in France.]—*Bull. Soc. Path. Exot.* 1921. Dec. Vol. 14. No. 10. pp. 645–648. With 1 text fig.

Between April 24 and May 13 the author examined faecal matter from 100 pigs, and found coccidia on 26 occasions. Further examinations showed that the number of infected pigs remained high during the summer, and that it decreased during the autumn. The oocysts found ranged from 13–30μ in length by 9–18μ in width. They were rather variable in shape, some being distinctly more rounded than others. The double contour of the envelope was distinct and the micropyle difficult to make out.

Diluted faeces which had been enriched by screening and sedimentation were placed in layers from ½ to 1 cm. thick in petri dishes and incubated at 25° C. Wood charcoal or 1 in 500 chromic acid were added to prevent putrefaction. Round sporoblasts were visible by the third day, and these had become elongated by the sixth day. Subsequently the sporozoites and residual body could be made out, but with some difficulty.

In the absence of cross immunity tests the author has not been able to decide whether the parasite of the pig is identical with that of cattle or not.

A ten-weeks-old pig, whose faeces had been examined with negative results for about three weeks, was fed with mature oocysts. The first oocysts were found in small numbers in the faeces on the seventh day. They increased somewhat in numbers up to the twelfth day and then became more scanty.

The author has not been able to detect naked-eye lesions in any of the pigs whose faeces contained the parasite nor have sections been obtained showing the parasite *in situ* in the tissues.

Pigs whose faeces contained large numbers of parasites were perfectly healthy in appearance. The infestation appeared to be a benign one.

YAKIMOFF (W. L.). **Les Protozoaires des animaux domestiques en Transcaucasie.** [The Protozoa of Domesticated Animals in Transcaucasia.]—*Bull. Soc. Path. Exot.* 1921. Dec. Vol. 14. No. 10. p. 652.

In 1915 the author examined the blood of 50 cattle, 35 horses and 20 dogs in the Transcaucasus.

In the cattle *P. bigeminum* was found once, *Sarcocystis blanchardi* 10 times, and *T. theileri* once. Theileria was not encountered. Neither microfilariae nor intracorpuscular parasites were found in the horses and dogs.

PARROT (L.). **Recherches sur l'étiologie du Bouton d'Orient (Clou de Biskra). Études sur la biologie de Phlebotomes en milieu endémique.** [The Etiology of Oriental Boil. The Biology of the Phlebotomus in an Endemic Area.]—*Bull. Soc. Path. Exot.* 1922. Jan. Vol. 15. No. 1. pp. 79–92.

The author found that only two species of Phlebotomus occur at Biskra, namely, *P. papatasii* and *P. minutus* var. *africanus*. It was suspected, and subsequently established, that the former is responsible for the transmission of the infection.

SAZERAC (R.) & LEVADITI (C.). **Étude de l'action thérapeutique du Bismuth sur la Syphilis.** [The Therapeutic Action of Bismuth in Syphilis.]—*Ann. Inst. Pasteur.* 1922. Jan. Vol. 36. No. 1. pp. 1–13.

The authors state that their experiments show that bismuth possesses remarkable spirillicidal properties, and that its action in both man and animals is comparable to that of the best antisyphilitic drugs known. It appears to be better than mercury, but is slower in action than the most active arsenical compounds.

They have tested a number of compounds with a view to detecting any relationship between their activity and their chemical composition. "Tartrobismuthate" is specially active, and is of comparatively simple composition.

They hope to be able to test the value of bismuth compounds analogous to certain arsenobenzene compounds, but with the arsenic replaced by bismuth.

Fournier (L.) & Guénot (L.). **Traitement de la syphilis par le bismuth.** [The Treatment of Syphilis by Bismuth.]—*Ann. Inst. Pasteur.* 1922. Jan. Vol. 36. No. 1. pp. 14–33.

Bismuth has been used for intramuscular injections in doses of 20–30 cgm. repeated 10–12 times within a month. No evidence of toxicity has been obtained and no ill-effects produced.

The objections to the treatment are :—

1. Evidences of reaction at the seat of puncture.
2. Practically constant impregnation of the buccal mucous membrane, as evidenced by black plaques, blueness of the tongue, and even slight stomatitis.

Bismuth exercises a rapid and prolonged action against syphilis, and particularly against the contagious forms.

On the other hand it produces a marked reduction, or even causes the complete disappearance, of the serum reaction.

It remains to be seen whether total and permanent cures of cases of syphilis can be effected by means of bismuth.

Fournier (L.), Guénot (L.) & Schwartz (A.). **Premiers résultats du traitement de la syphilis par l'acide oxyaminophenylarsinique (sel de soude), or "189."** [The First Results of the Treatment of Syphilis by the Sodium Salt of Oxyaminophenylarsenic Acid, or "189."]—*Ann. Inst. Pasteur.* 1922. Jan. Vol. 36. No. 1. pp. 53–62.

The authors conclude that the drug exerts a powerful antisyphilic action and causes the rapid disappearance of primary and secondary lesions. In rare instances a relapse follows the first series of injections.

Its action upon complement fixation is slow and as a rule is obvious after the second series of injections only, when complement fixation may be weak or negative.

"189" has not been responsible for any serious local or general ill-effects.

Levaditi (C.) & Navarro-Martin (A.). **Action thérapeutique de l'acide oxyaminophénylarsinique dans la Spirillose des poules et la syphilis expérimentale du lapin.** [The Effect of Oxyaminophenylarsenic Acid in Fowl Spirillosis and Experimental Syphilis in the Rabbit.]—*Ann. Inst. Pasteur.* 1922. Jan. Vol. 36. No. 1. pp. 46–52.

The authors' experiments have been carried out with the acid itself, its sodium salt, its acetyl derivative and the calcium salt of the latter, and they come to the conclusion that Ehrlich and Hata's view that the arsenic acids cannot be used without ill-effects in the treatment of trypanosomiases and spirilloses is not justifiable.

The curative doses of the above compounds are higher than that of "606," the therapeutic coefficient being $\frac{1}{4}$ as compared with $\frac{1}{8}$. It is possible that this is due to the more rapid elimination of the drugs. This defect is counterbalanced by the fact that "189" can be injected subcutaneously and acts promptly.

Chambers (F.). **Piroplasmosis of the Reindeer.**—*Vet. Jl.* 1921. Nov. Vol. 77. No. 11. pp. 415–419.

Dixon (R. W.). **East Coast Fever.—Its Prevention and Eradication.**—*Union of S. Africa. Jl. Dept. Agric.* 1921. Nov. Vol. 3. No. 5. pp. 436–445.

FRANCHINI (G.). **Sur les flagellés intestinaux du type Herpetomonas du** *Chamaeleon vulgaris* **et leur culture, et sur les flagellés du type Herpetomonas de** *Chalcides* (*Gongylus*) *ocellatus* **et** *Tarentola mauritanica*. [The Intestinal Flagellates of the Herpetomonas Type of *Chamæleon vulgaris* and of *Chalcides ocellatus* and *Tarentola mauritanica*.]—*Bull. Soc. Path. Exot.* 1921. Dec. Vol. 14. No. 10. pp. 641–645.

DE GASPARI (F.). **Morbo coitale maligno e anafilassi. Alcune ricerche sperimentali sulla sensibilizzazione delle'organismo animale con i prodotti tossici dei tripanosomi e con le sensibilisine di cui quelli provocano la formazione.** [Dourine and Anaphylaxia Experiments regarding the Sensitization of Animals with Toxic Products of Trypanosomes and the Sensibilizine to which they give rise.]—*Clin. Vet.* 1921. Sept. 15. Vol. 44. No. 17. pp. 471–487.

LANFRANCHI (A.) & SANI (L.). **L'intrapalpebro-reazione nella diagnosi del morbo coitale maligno.** [The Intra-palpebral Reaction in the Diagnosis of Dourine.] —*Clin. Vet.* 1921. Nov. 15–30. Vol. 44. Nos. 21–22 pp. 647–650.

LAVIER (G.). **Hémogrégarines, Grahamella, Spirochète et Trypanosome du campagnol indigène** *Microtus arvalis* **Pallas.** [Haemogregarines, Grahamella, Spirochaeta and Trypanosome of the Field Mouse.]—*Bull. Soc. Path. Exot.* 1921. Nov. Vol. 14. No. 9. pp. 569–576. With 5 text figs.

NOYER (E.). **Über Beschälseuche.** [Dourine.]—*Schw. Arch. f. Tierheilk.* 1921. Nov. Vol 63. No. 11. pp. 451–466.

PRICOLO (A.). **Terza nota sulla piroplasmosi da** *Theileria parva* **nell'Africa del Nord.** [Third Note on the Occurrence of *Theileria parva* in North Africa.]—*Clin. Vet.* 1921. Sept. 30. Vol. 44. No. 18. pp. 503–512.

SANI (L.). **Il morbo coitale maligno in Italia ed i diversi metodi di diagnosi sperimentale.** [Dourine in Italy and the Various Methods employed for Diagnosis.]—*Clin. Vet.* 1922. Feb. 16 & 28. Vol. 45. No. 3. pp. 87–94 (to be continued).

TROUT (C L.). **Treatment of Trypanosomiasis by Various Methods.**—*Jl. Trop. Med. & Hygiene.* 1921. Dec. 15. Vol. 24. No. 24. pp. 321–322.

YAKIMOFF (W. L.), WASSILEWSKY (W. J.), KORNILOFF (M. T.) & ZWEITKOFF (N. A.). **Flagellés de l'intestin des animaux de laboratoire.** [Intestinal Flagellates of Laboratory Animals.]—*Bull. Soc. Path. Exot.* 1921. Nov. Vol. 14. No. 9. pp. 558–564. With 1 text fig.

DISEASES DUE TO METAZOAN PARASITES.

MAURIAC (P.) & BOYER (R.). **Recherches expérimentales sur le traitement de la distomatose par les injections intraveneuses d'émétique.** [Experimental Investigations of the Treatment of Distomatosis by Intravenous Injections of Emetic.]—*C.R. Soc. Biol.* 1921. Nov. Vol. 85. No. 33. pp. 917–919.

Four sheep, in the faeces of which the eggs of the large and small fluke and of a strongyle were discoverable, were selected for experiment. A 4 per cent. solution of emetic was given intravenously.

The first animal received a total quantity of 0·86 gm. within a period of 16 days. Progressive doses ranging from 1–12 cgm. were given daily. There was no systemic disturbance of any kind. The animal was killed at the end of the period. The liver was markedly cirrhotic and 56 absolutely unaffected large flukes and large numbers of small ones were found.

It was found that doses of emetic which were sufficiently large to produce marked toxic symptoms in the two other sheep—they received total amounts of 2·16 gm. and 3·71 gm. respectively—failed to exercise any effect upon the flukes.

Emphasis is laid upon the necessity of making frequent and prolonged examinations of the faeces for eggs in experiments of this kind, in order to avoid inaccurate deductions.

BOUIN. **Filariose et microfilariose des animaux domestiques dans le sud Morocain.** [Filariasis and Microfilariasis of the Domesticated Animals in Southern Morocco.]—*Rec. Méd. Vét.* 1921. Nov.–Dec. Vol. 97. No. 22–24. pp. 464–467

No new species are described in this paper, the author's aim being mainly to record the occurrence of certain species. They are as follows :—

1. In the dog—
    a. *Filaria immitis.*
    b. *Acanthocheilonema dracunculoides.*
2. In the dromedary—
    a. *Filaria evansi.*
3. In the ox—
    a. *Filaria labiato-papillosa.*

GEDOELST (L.). **Quelques nématodes parasites de l'elephant africain.** [Some Nematode Parasites of the African Elephant.]—*Bull. Soc. Path. Exot.* 1922. Feb. Vol. 15. No. 2. pp. 122–127.

The author has found three species of worms in faeces from an African elephant at Api, only one of which is new.

The two known species were *Amira pileata,* and *Murshidia recta.*

The third is provisionally placed in the genus *Ascaridia* (Railliet and Henry) which up to the present comprises only parasites obtained from birds, but which LANE holds will have to be sub-divided.

The main features are as follows. The body is tapered at both ends and shews pronounced transverse striations. The mouth is terminal and triangular. The dorsal lip has two large papillae, and the subventral lips one each. The males and females are not markedly different in length (about 24 mm.). The author has had only one male worm for examination. The caudal extremity has poorly developed lateral wings. The genital papillae are large and there are nine pairs. The spicules are practically equal in length (3·5 mm.). The genital tube makes many convolutions around the intestine.

Female.—The lips of the vulva are not prominent, and the orifice is posterior to the midpoint of the body. The ovijector is directed forwards and from it two divergent uteri arise. These pass forwards and backwards, the one to within 2·8 mm. of the oesophagus and the other to within the same distance of the anus.

The eggs measure 80 by 48μ.

SCHWARTZ (B.). **Hemotoxins from Parasitic Worms.**—*Jl. Agric. Res.* 1921. Nov. 19. Vol. 22. No. 8. pp. 379–432.

Apart from the importance of the author's experimental work described in this paper, the publication has an added value in that it contains a full account of the previous contributions, which are succinctly summarized, and a full list of references.

It would appear that the following points have hitherto been established :—

" 1. Certain parasitic worms secrete substances that affect the blood of the host deleteriously. These substances, which may be designated as hemotoxins, are in general nonspecific in that they are also active toward blood of animals other than their normal host.

" 2. *Diphyllobothrium latum,* a tapeworm which is known to cause severe anaemia, contains a hemolytic agent. It appears questionable that this agent is oleic acid, as claimed by FAUST.

" 3. Concerning hemolysins in cestodes other than *Diphyllobothrium latum* no definite conclusions can be drawn from the literature on the subject; but that hemolysins are present in several species appears probable.

" 4. *Schistosoma japonicum* secretes an ether-soluble hemolysin.

" 5. Hookworms (Ancylostoma and Necator) secrete a hemolysin and an anticoagulin.

" 6. Whipworms (*Trichuris trichiura*) apparently secrete a hemolysin.

" 7. Worms belonging to the genus Ascaris contain a hemolysin which is closely bound to the tissues of the worms and is therefore but slightly soluble in water, which fact accounts for the negative results obtained by certain investigators. These parasites also appear to secrete a feeble anticoagulin.

" 8. Worms of the genus Strongylus secrete a hemolysin and an anticoagulin. The hemolytic principle of these parasites is apparently an alkaloid, although other substances found in them show hemolytic power.

" 9. *Haemonchus contortus* apparently secretes a weak hemolysin.

" 10. Extracts of *Macracanthorhynchus hirudinaceus* are apparently destructive to erythrocytes.

" 11. Hemolytic and anticoagulating properties are found in extracts of species of Gastrophilus.

" 12. Hemolytic substances from parasites are soluble in alcohol and ether, thus resembling lipoids.

" 13. With respect to their resistance to heat, hemolysins from animal parasites vary, but in general they are thermostable."

Summary of the results obtained in the present investigation :—

" Extracts of *Ascaris lumbricoides* contain active substances that affect blood deleteriously. The hemolysin which these abstracts contain is a thermostable, nonspecific, alcohol-soluble substance which appears to be rather firmly bound to the cells of the parasite, presumably to the cells of the intestine in which it is elaborated. The hemolytic potency of extracts of *A. lumbricoides* is not due solely to fatty acids, since chemical fractions of the worms from which the fatty acids have been removed by ether extraction are hemolytic. The hemolysin is neutralized by normal blood serum.

" The body fluid of *A. lumbricoides* shortly after removal from the host contains oxyhemoglobin and is nonhemolytic. It acquires hemolytic powers, however, as the worms are kept alive in vitro for a few days, and loses at the same time its oxyhemoglobin content.

" Body fluid from fresh specimens of *Ascaris lumbricoides* does not activate a hemolytic system, and alcohol-soluble fractions of the worms from which ether-soluble substances have been removed does not act as complement in combination with inactivated normal guinea-pig serum.

" The hemagglutinin from *Ascaris lumbricoides* is a salt-solution-soluble substance and has special affinities for rabbit blood cells. Unlike the hemolysin, its action is not hindered by low temperatures (6° to 8° C.).

" *Ascaris lumbricoides* secretes a substance that inhibits the coagulation of blood. This substance is present in the body fluid of the worm, and has but a comparatively slight potency.

" *Ancylostoma caninum* secretes a nonspecific hemolysin, soluble in salt-solution, relatively thermolabile and inactive at low temperatures. Normal blood serum inhibits the action of hookworm hemolysin.

" *Bustomum* [? *Bunostomum*] *phlebotomum* secretes a hemolysin having properties similar to that of *Ancylostoma caninum*. This hemolysin is completely soluble in alcohol.

" Salt-solution extracts of *Haemonchus contortus* have but a feeble hemolytic action.

" Salt-solution extracts of *Ancylostoma caninum* and of *Bustomum phlebotomum* do not inhibit the coagulation of rabbit blood to any marked degree.

" A weak hemolytic substance is present in abstracts of *Trichuris depressiuscula*.

" *Thysanosoma actinoides* contains an alcohol-soluble hemolysin. Alcohol-soluble fractions of *T. actinoides* from which the ether-soluble fraction has been removed are hemolytic, showing that substances other than fatty acids are removed. The hemolysin from this cestode is active at 8° C. and is neutralized by normal blood serum.

" Extracts of a species of Moniezia similar to those of *Thysanosoma actinoides* are non-hemolytic."

VIALATTE (Ch.) & PARROT (L.). **Phlébotomes du Maroc.** [Phlebotomus in Morocco.]—*Bull. Soc. Path. Exot.* 1921. Nov. Vol. 14. No. 9. p. 566.

The authors point out that apart from the single reference to the subject by DELANOË (1915) nothing is known regarding the distribution of Phlebotomus in Morocco. They now record the occurrence of *P. papatasii*, *P. perniciosus* (*Sergentomyia perniciosa*), *P. minutus* var. *africanus*.

CURASSON (G.). **La gale chorioptique du bœuf au Sénégal et au Soudan.** [Chorioptic Mange of the Ox in Senegal and the Sudan.]—*Rec. Méd. Vét.* 1922. Jan. 15. Vol. 98. No. 1. pp. 14–19.

The disease appears after the rains, that is in November and December. Although the animals seen by the author were affected almost all over their bodies, the oldest looking and therefore probably the original seats of the lesion were at the root of the tail and the croup. Pruritus appeared to be very slight, and such lesions as were present were due to the irritation of the parasite itself and not to rubbing. The affection spreads with remarkable rapidity over the body. The disease yields rapidly to treatment. Ointments are to be avoided as the sun causes them to blister the skin. The native treatment, of which the author has a good opinion, comprises washing with urine, which has undergone ammoniacal fermentation, to clean the surface of the skin and then using a decoction of the astringent bark of the baobab tree, tobacco leaves and indigo. Simple washing with native soap followed by water containing cresyl has given good results. Old standings should be abandoned and fresh places made, one for the diseased and a larger one for the healthy.

The disease does not spread naturally to other animals, but the horse can be infected experimentally. In the horse the condition is of brief duration. Attempts to infect sheep and goats were all, with one possible exception, failures.

Blacklock (B.). **Notes on an Apparatus for the Individual Breeding of Mosquitoes.**—*Ann. Trop. Med. & Parasit.* 1921. Dec. Vol. 15. No. 4. pp. 473–477. With 5 text figs.

Cawston (F. G.). **Three Schistosomes in Natal which possibly attack Man.**—*Jl. Trop. Med. & Hyg.* Sept. 15. 1921. Vol. 24. No. 18. pp. 242–244. With 2 text figs.

Cawston (F. G.). **The Treatment of Fluke Diseases.**—*Jl. Trop. Med. & Hyg.* Oct. 1. 1921. Vol. 24. No. 19. pp. 254–255.

Cawston (F. G.). **A Series of Cases of Bilharzia Disease treated with Tartar Emetic.**—*Jl. Trop. Med. & Hyg.* Oct. 15. 1921. Vol. 24. No. 20. pp. 267–268.

Cawston (F. G.). **Bilharzia Infection in the Pool, the River, and the Lagoon.**—*Jl. Trop. Med. & Hyg.* 1922. Jan. 16. Vol. 25. No. 2. pp. 16–18.

Davey (J. B.) & Newstead (R.). **Mosquitoes and other Blood-Sucking Arthropods of the Upper Shiré River, Nyasaland.**—*Ann. Trop. Med. & Parasit.* 1921. Dec. Vol. 15. No. 4. pp. 457–463.

Descazeaux (J.). **Traitement de l'habronémose cutanée.** [The Treatment of Cutaneous Habronemosis.]—*Rec. Méd. Vét.* 1921. Nov.–Dec. Vol. 107. No. 22–24. pp. 489–492.

Ghesquière (J.). **Rapports de l'entomologiste. Laboratoire d'entomologie d'Eala. No. 6. Note sur quelques parasites des oiseaux de basse-cour au Congo belge.** [Reports of the Entomologist, Entomological Laboratory, Eala. No. 6. Some Parasites of Poultry in the Belgian Congo.]—*Bull. Agric. Congo belge.* 1921. Dec. Vol. 12. No. 4. pp. 727–730

Ihle (I. E. W.). **On the Genus Cylicostomum.**—*Ann. Trop. Med. & Parasit.* 1921. Dec. 30. Vol. 15. No. 4. pp. 397–402. With 3 text figs.

Johnston (T. H.). **The Nodule Parasite and Allied Worms from Queensland Cattle.**—*Queensland Agric. Jl.* Sept. 1921. Vol. 16. No. 3. pp. 172–174.

Maplestone (P. A.). **Notes on Australian Cestodes.**—*Ann. Trop. Med. & Parasit.* 1921. Dec. 30. Vol. 15. No. 4. pp. 397–412. With 5 text figs.

Monnier (A.). **À propos de l'habronemose cutanée.** [Cutaneous Habronemosis.]—*Rec. Méd. Vét.* 1921. Nov–Dec. Vol. 107. No. 22–24. pp. 459–464.

Schwetz (J.). **La présence de pupes de *Glossina palpalis* à 1,500 m. de l'eau.** [The Presence of Pupae of *Glossina palpalis* at a Distance of 1,500 metres from Water.]—*Bull. Soc Path. Exot.* 1922. Jan. Vol. 15. No. 1. pp. 23–25.

Soparkar (M. B.). **The Cercaria of *Schistosomum spindalis* (Montgomery).**—*Indian Jl. Med. Res.* 1921. July. Vol. 9. No. 1. pp. 1–22. With 2 plates.

Soparkar (M. B.). **Notes on some Furcocercous Cercariae from Bombay.**—*Indian Jl. Med. Res.* 1921. July. Vol. 9. No. 1. pp. 23–32. With 6 plates.

Travassos (L.). **Contribuições para o con hecimento da fauna helmintolojica brasileira. XII. Sobre as Especies Brasileiras da sub-familia Brachycoelinae.** [Brazilian Helminths. (Brazilian species of the sub-family Brachycoelinae).]—*Archir da Escola superior de Agric. e Med. Vet.* 1921. Sept. Vol. 5. Nos. 1 & 2. pp. 59–68. With 3 plates.

BACTERIAL DISEASES.

Brocq-Rousseu, Forgeot (P.) & Urbain (A.). **Sur la formation des anticorps à la suite des Injections de Malléine.** [The Formation of Antibodies following Injections of Mallein.]—*Ann. Inst. Pasteur.* 1921. Dec. Vol. 35. No. 12. pp. 879–892.

All investigators have found that mallein injections are superior to such methods as agglutination, complement-fixation, etc. But it is admitted that the latter methods are valuable in some instances in which the results yielded by mallein are doubtful.

In view of this fact it is of importance to ascertain whether injections of mallein influence the antibody content of the serum.

A number of tests were carried out with this object in view.

Conclusions.

1. The intradermal injection of 0·1 cc. of "Malléine au quart" [crude mallein made up to 4 volumes.—A.L.S.] repeated four times at regular intervals caused the appearance of antibodies in 2 cases out of 5, a proportion of 40 per cent.
2. A first subcutaneous injection of 2·5 cc. of "Malléine au dixième" [*i.e.*, dilute mallein.—A. L. S.] causes the appearance of sensitizer in the blood in 4 out of 5 horses, *i.e.*, 80 per cent. After a second injection antibodies are constantly present.
3. Horses, which show no antibodies after four successive palpebral injections of mallein, show them four days after a subcutaneous injection. They receive in fact in this case a dose of crude mallein ten times as big as that given in the first injections.
4. The antibodies formed either after an intradermal test or after a subcutaneous test appear from the fourth to the eighth day after the injection. They always disappear after the forty-fifth day.
5. In glandered animals the richness of the serum in antibodies is markedly increased by an injection of mallein

The practical conclusion to be drawn from the work is that if it is desired to combine the complement-fixation test with a mallein test for the diagnosis of glanders, the blood must be taken immediately after the injection of the mallein, and in any case before the fourth day or after the forty-fifth day.

The blood should, of course, be taken prior to the test, but as complement-fixation is usually necessary in cases of doubtful results the blood is as a rule taken on the day following the test.

Hoskins (H. P.). **The Occurrence of Virulent and Non-virulent Strains of the Hemorrhagic Septicaemic Organism in the same Animal.**—*Jl. Amer. Vet. Med. Assoc.* 1922. Jan. Vol. 60. No. 4. pp. 453–460.

The investigations recorded in this paper were carried out with materials derived from the lungs and muscles of calves dead of the pulmonary form of haemorrhagic septicaemia (stockyard pneumonia). From the lung and muscle by direct culture, and from the muscle by rabbit passage three cultures, all apparently the same and corresponding with *Bacterium bovisepticum,* were obtained. It was observed that the broth cultures of the strain isolated direct from the muscle were heavier and did not clear up as did the lung strain, but no particular attention was paid to this at the time, as similar differences had been observed at other times when a single strain was grown in different batches of media. An emulsion of lung tissue failed to kill a rabbit; the question as to the virulence of the lung strain therefore arose.

Rabbits inoculated with both cultures of the lung strain failed to die, nor did repeated inoculations produce any immunity. Rabbits inoculated with the muscle strains, whether isolated direct or through rabbits, died.

The conclusion drawn by the author from these results is indicated by the title of the paper.

Non-virulent organisms of the haemorrhagic septicaemia type have been isolated by the author from the air passages of a number of animals, but this is the first instance in which the author has obtained virulent and non-virulent forms from the same animal.

In this case cultures were not made from the blood.

D'HÉRELLE (F.) & LE LOUET (G.). **Sur la vaccination antibarbonique par virus atténué.** [Antibarbone Vaccination with Attenuated Virus.]—*Ann. Inst. Pasteur.* 1921. Nov. Vol. 35. No. 11. pp. 741–744.

The authors had at their disposal two strains of barbone cultures. One of these was in the blood of a rabbit which had died after inoculation, the blood having been preserved in sealed ampoules for sixteen months. The other was a Martin's broth culture of the same rabbit preserved in ampoules. Four young bulls and four buffaloes inoculated with 1 cc. of an eighteen-hours culture made from the preserved rabbit blood failed to show any reaction save for a slight rise of temperature in two of them. All these animals together with two bulls and one buffalo as controls were subsequently inoculated with a virulent culture at intervals of from 13–25 days. None showed any reaction except the controls, all of which died within 24 hours.

It is noted that the immunity was established although the animals showed no evidence of reaction.

The authors believe that passage through rabbits was responsible for the attenuation, a view which is supported by the fact that an Indo-Chinese strain which proved fatal in a dose of $\frac{1}{5000}$ cc. failed to kill in a dose of $\frac{1}{50}$ cc. after eight passages through rabbits. This dose, although it failed even to produce any reaction, conferred immunity. In order to verify the effect of cultures preserved in ampoules the remainder of the culture used for the four buffaloes referred to above was divided up and sealed in ampoules. Sixteen days later two bulls were inoculated with 1 and 0·5 cc. respectively. The former died in 24 hours and the latter in 39 hours. It therefore appeared that a fresh culture in beef broth failed to produce a reaction but conferred immunity, while the same culture after an interval produced a fatal effect. The result was the same when the conditions of the experiment were varied.

On the assumption that an attenuated organism remains attenuated if it is preserved in rabbit's blood the authors desired to ascertain whether the nature of the culture medium would affect the result of inoculation.

The experiments designed to elucidate this point showed that a beef broth culture of an attenuated strain caused fatal infection, although the culture may be recent. On the other hand the inoculation only confers immunity when the attenuated organism is cultivated in a medium prepared from rabbit flesh, even if the cultures are old. Antibarbone cultures for immunizing purposes should therefore be made in broth prepared from rabbits.

BEVAN (L. E. W.). **Infectious Abortion of Cattle and its possible relation to Human Health.**—*Rhodesia Agric. Jl.* 1921. Dec. Vol. 18. No. 6. pp. 582–592.

" Conclusions :—

" 1. The disease known as infectious abortion of cattle which exists in Southern Rhodesia, is caused by the *Bacillus abortus*, Bang, and serological tests indicate that it is identical with the specific abortion of cattle in other parts of the world.

"2. The *Bacillus abortus* of Bang bears a close morphological and biological resemblance to the *Micrococcus melitensis*. Serological tests also indicate a close affinity, in that certain strains of *M. melitensis* can be agglutinated with serum from cattle infected with infectious abortion, and strains of *B. abortus* can be agglutinated by serum from patients suffering from undulant fever.

"3. The characteristic symptom of undulant fever in goats and sheep is abortion.

"4. Certain cases presenting symptoms resembling undulant fever have occurred in Southern Rhodesia in men who, so far as is known, have not obtained infection from goats, but have resided on farms where animals are or have been infected with infectious abortion.

"5. It is suggested that these cases are suffering from an infection caused by the *Bacillus abortus* of cattle.

"6. It is also suggested that human females may contract infectious abortion through the ingestion of the organism in milk and dairy products from infected cows.

"7. Although infectious abortion is prevalent in other parts of the world where goat's milk is not used for human consumption, it has not been accused of causing the symptoms of undulant fever in man nor has it been proved to cause abortion in human subjects.

"8. Although infectious abortion has prevailed in the Marandellas district for many years, it is only within the last few months that cases resembling undulant fever in man have been recorded.

"9. While circumstantial evidence points to the infection of man by the *Bacillus abortus* of Bang, and scientific tests up to a point support this suspicion, the final proof is not yet available.

"10. If infectious abortion of cattle is essentially a bovine disease, a grave responsibility attaches to the Veterinary Department; and if this disease is communicable to man, a hearty co-operation between the medical and veterinary professions is necessary in dealing with it."

VAN SACEGHEM (René). **La Pneumonie contagiense des Chèvres au Ruanda.** [Contagious Pneumonia of Goats.]—*Bull. Agric. Congo belge.* 1921. Sept. Vol. 12. No. 3. pp. 502–505.

The disease is very contagious and is sometimes associated with enteritis. Infection is by ingestion. Native sheep are immune. Acute and chronic cases are seen. The symptoms are those of pleuro-pneumonia, with some degree of paralysis before death occurs.

The author has been able to isolate a gram-negative, motile cocco-bacillus, with which he has been able to reproduce the disease. On agar at 22° C. a thin varnish-like growth develops. On gelatin transparent colonies are formed which become opaque and viscous. On potato a thick coffee-coloured layer is formed. In broth there is uniform turbidity, and glucose is fermented. Milk is not coagulated.

The organism is said to possess all the characters of Paratyphoid B. Virulence decreases with the age of cultures, but cultures remain viable for months. The course of the disease produced by inoculation varies with the method employed. Intravenous inoculation produces death within a few hours, while the subcutaneous injection of culture produces chronic pneumonia.

ALLEN (H.). **An Atypical Outbreak of Haemorrhagic Septicaemia.**—*Vet. Jl.* 1922. Feb. Vol. 78. No. 2. pp. 56–58.

MASINI (G.). **Contributo allo studio degli insuccessi e degli accidenti vaccinali nella profilassi del carbonchio ematico.** [Contribution to the Study of the Failures and Accidents in Preventive Inoculation against Anthrax.]—*La Clin. Vet.* 1921. Dec. Vol. 45. Nos. 23–24. pp. 671–676.

MOSCOSO (L. E.). **Un nuevo y facil medio de cultivo del bacilo de Bang. Su empleo para la producción de vacuna.** [A New and Easy Medium for the Cultivation of Bang's Bacillus. Its Use for the Production of Vaccine.] —*Revista de Hyg. y Sanid. Pecuarias.* 1921. July. Vol. 11. No. 7. pp. 375–378.

RAVENNA (E.). **Immunizzazione e Terapia del Carbonchio sintomatico sperimentale.** [Immunization and Therapeutics in Experimental Blackquarter. —*La Clin. Vet.* 1921. Oct. 31. Vol. 44. No. 20. pp. 573–582.

RONCA (V.). **Ricerche ematologiche nel carbonchio sintomatico sperimentale.** [Blood Examinations in Experimental Blackquarter.]—*La Clin. Vet.* 1921. Dec. Vol. 44. Nos. 23–24. pp. 676–694.

DISEASES DUE TO FILTERABLE VIRUSES.

THEILER (Arnold). **African Horse Sickness** (*Pestis Equorum*). **Peresiekte or Paardenziekte (Dutch), Pferdesterbe (German), La peste du cheval (French), La peste equina (Italian).**—*Union of South Africa, Department of Agriculture. Science Bulletin.* No. 19. Pretoria: Govt. Printing & Stationery Office. 1921. (Price 3d.).

In this bulletin, which comprises some 30 pages, the author gives a summary of the present state of knowledge regarding African horse sickness.

In the opening section the history and geographical distribution of the disease are dealt with. It would appear that it has been known for more than 300 years, and that references to it can be found in official documents which are 200 years old. Between 1780 and 1854 severe visitations of the disease were experienced at intervals of about 20 years. In the last-named year the mortality was 40 per cent. of the total number (161,000) in the Colony. The disease since that date has been found to occur in many parts of the African Continent. So far as is known at present it is only Western and Central Western Africa from the Congo to the Mediterranean that are free from the disease. It has been reported in Southern Arabia, but it is not certain that it actually exists east of the Red Sea. It is not now known in the extreme south of the continent as it was in the past, and Basutoland and large areas in the Free State are not horse sickness areas. It is rarely found on high veldt, and the permanent home of the disease appears to be the low-lying coastal belt on the south-east and east.

In most parts the disease has a seasonal distribution. It makes its appearance during the summer months, increases during the autumn, and comes to a sudden stop with the first frost (April–May). It is a common experience that horses may be turned out to grass with safety nine days after the first frost. Horse sickness makes its appearance in districts outside the low-lying areas only when the rainfall is exceptionally heavy and when the rains are succeeded by warm weather.

Horses and mules running free day and night are most severely attacked. Those kraaled or stabled at night escape infection more or less in proportion to the quality of the shelter provided. The value of insect-proof stables has been established for years. The period between sunset and sunrise is the most dangerous one. The cause of the disease is a filterable virus which is present in the blood and serum of an infected animal. The virus can be transmitted by inoculation. It cannot be separated from the corpuscles by washing, and cannot be sedimented from the serum.

Horses, mules and donkeys are susceptible. Mortality among the first of these amounts to about 95 per cent. Only a proportion of donkeys are susceptible, and in this species infection produces only a rise of temperature. No death has been recorded. The susceptibility of mules is rather less than that of horses.

The dog is susceptible by inoculation or ingestion. Young angora goats have been infected—a rise of temperature being the only symptom. A peculiar observation was made with goats. The virus after passing through the goats was infective for dogs, but the virus from these was non-infective for the horse. Viruses vary in virulence. Some produce a rapidly fatal result when ·0001 cc. of blood is injected. Others may fail to infect when a dose of 1 cc. is used. Viruses lose virulence with age, and weak viruses quicker than strong ones. Blood may remain infective although putrid, but certain bacteria which are responsible for putrefactive changes, and which have not as yet been studied, are destructive to the virus. The virus loses vitality at 50° C. It is not destroyed by 3 per cent. carbolic acid, 10 per cent. sodium taurocholate, or 10 per cent. saponin. A virus mixed with a 5–10 per cent. solution of lecithin fails to infect, but becomes virulent again when the two are separated. Drying at ordinary temperature destroys the virus.

Horse sickness appears under climatic conditions identical with those favouring the development of malaria in man, but horse sickness can spread over a wider area and to greater altitudes than human malaria. These facts, coupled with the value of insect-proof stables, strongly indicate that the disease is insect-transmitted, but no insect has, as yet, been incriminated. The evidence appears to indicate that the transmitting agent may be found among the Culicinae (viz., Ochlerotatus), and that the infection is passed on through the egg to the succeeding generation.

The reservoir of the virus has not been traced, but it is known that the blood of inoculated horses may remain infective for periods up to three months after inoculation. There is reason, however, to suspect that a non-equine reservoir may exist.

Three forms of horse sickness may be recognized clinically: (1) the pulmonary form, (2) the oedematous or cardiac form, and (3) a combination of the two. The pulmonary form corresponds with that recognized clinically as dunkop, while the oedematous form is the dikkop type.

In the pulmonary form the thoracic organs and glands are saturated with a greenish yellow clear exudate, and the lungs are fully inflated. The pleural cavity contains a variable amount of clean fluid, up to several litres. The trachea and bronchi are filled with froth. Ecchymoses are present under the epi- and endo-cardium.

There is usually a viscid mucous deposit in the fundus and pylorus of the stomach, and the mucous membrane may show diffuse or patchy reddening. This may amount to actual extravasation. The spleen is generally normal, but may be slightly enlarged.

In the dikkop type of disease the striking lesions are in the subcutaneous fatty tissue in the temporal fossae, over the masseters, the mandibular space and the parotid region. In these areas the tissue is swollen and oedematous. Similar conditions may be found in and between the muscles of the neck. The mucous membrane of the mouth and tongue may be bluish, and the tongue itself infiltrated with exudate. The epicardium and endocardium may show extensive or patchy extravasations. The mixed forms of the disease in which pulmonary and cardiac lesions are found form the minority.

In addition to the three forms described above a fourth—the horse sickness fever form—can be recognized. This is the most difficult form to diagnose, as there are no pathognomonic symptoms. But the general course of the fever is characteristic. It is of the remittent type with morning remissions and evening exacerbations. The period of incubation and duration of the fever vary with the virulence of the virus and the susceptibility of the animal.

Clinically the pulmonary form of the disease is the most acute. The period of incubation is from two to five days (after experimental inoculation with a strong virus). The temperature curve is typical of the disease and the animal dies when the temperature has reached its height. All the symptoms of respiratory distress are present. Then coughing begins, and this amounts in some cases to actual fits of coughing. The cough is at first dry, but subsequently moist and gurgling, and an increasing escape of frothy discharge occurs after the attacks. Sometimes animals die without having ejected any froth, but it is always found around the nostrils after death.

The oedematous form of the disease " dikkop " is usually seen after the injection of weak viruses, and in animals whose immunity breaks down under natural infection.

As in the dunkop form of the disease the period of incubation and the duration of the disease vary with the strength of the virus. The symptoms which characterize the condition appear after the typical horse sickness fever has passed its maximum (*i.e.*, 14–15 days after inoculation in experimental cases). If they appear before that a fatal termination is certain.

The mixed form is rare and usually develops in an animal showing either the pulmonary or the cardiac form to a slight extent In slight pulmonary cases the cardiac form may develop suddenly and *vice versa*.

Paralysis of the oesophagus is one of the complications of horse sickness and is usually seen in severe cases of dikkop. At the post-mortem in such cases the oesophagus may be found packed with food.

While it cannot be stated definitely that there exist horses and mules which are not susceptible to horse sickness, horses have been encountered in experimental work which could not be infected. In horse sickness immunity is a relative condition depending both upon the natural degree of resistance possessed by the animal and the virulence of the virus. The latter factor appears to be the predominating one.

A horse which has successfully passed through an attack of the disease can be reinfected, but relapses do not occur.

Figures are not available to show the proportion of cases in which recovered (or salted) animals become reinfected, but it may be gathered from the results obtained in a large number of experimentally immunized horses that the percentage may be as high as 30 and as low as 6.

Death is likely to take place in about 30 per cent. of these cases. The solidity of the immunity conferred by an attack of horse sickness is not related to the severity of the attack. Horses and mules immune to any virus will react to some extent to inoculation with another virus. The immunity possessed by a horse which has been twice infected is stronger than that produced by a single attack.

Preventive measures.—(1) Preventing the horses from being bitten by the carrier, (2) Protective inoculation. Under the first heading come (*a*) insect-proof stables, (*b*) the application to the skin of some dressing deterrent to insects.

Under the second heading the process of the production of immune serum is described. Blood is passed from the jugular of the virus-producer by direct transfusion into the jugular of the serum-maker. Experience has shown that at least ten litres must be transfused. Bleedings are taken at four intervals of five days each, and 5–6 litres are taken on each occasion. In about 2 per cent. of cases transfusion causes symptoms of intoxication.

For the immunization of mules the virus is the same as that used for the hyperimmunization of horses. At the height of fever the blood is collected in an equal quantity of a mixture of 500 cc. water, 500 cc. glycerine, 5 gm. sodium oxalate, and 5 gm. carbolic acid.

Mules are immunized by the simultaneous injection of virus and serum (300–350 cc.), both intrajugularly.

In the immunization of horses a preliminary intravenous inoculation of 5 cc. of weak virus is given. This is followed on the sixth day with an intravenous inoculation of 3 cc. of strong virus and on the eighth day by an intravenous injection of serum at the rate of ·75 cc. per kilo body weight.

For the injection of serum a long canula of small bore is recommended, as this does not move when the nozzle of the syringe is inserted. Injury to the intima and subsequent thrombosis are thus avoided. A small bore is advised to prevent the too rapid introduction of the serum, which is likely to produce symptoms of shock.

It is most important in selecting virus not to use horses which have suffered either from biliary fever or pernicious anaemia. Any risk of infection with Nuttallia can be prevented by using blood which has been stored for a month. This procedure does not render pernicious anaemia blood safe, as the virus persists for a year or more.

It has to be ascertained whether the immune blood which is collected for serum contains haemolysins. The presence of these is ascertained by mixing 2 cc. of serum with ½ cc. of washed corpuscles and incubating. The percentage of horses rejected for this reason is about 10. As immune serum may contain the virus of pernicious anaemia, experiments have shown that after storage for a year it is no longer virulent, and that the protective properties of the serum are not decreased.

It must be remembered that when horses are being inoculated in succession there is a risk of conveying the virus of pernicious anaemia unless steps are taken to sterilize the syringes after each injection.

Immunized horses must be nursed carefully for a month, and mules for about three weeks, after the operation.

The paper concludes with a list of references to horse sickness.

VAN SACEGHEM (René). **La Transfusion sanguine dans l'Hyperimmunisation des Bovidés contre la Peste bovine.** [Transfusion of Blood in the Hyperimmunization of Cattle against Rinderpest.]—*Bull. Agric. Congo belge.* 1921. Sept. Vol. 12. No. 3. pp. 491–492.

The author has introduced direct transfusion into the method of preparing anti-rinderpest serum as carried out at the laboratories at

Kissegnies, because in his opinion the classical method of injecting several litres of defibrinated or citrated blood subcutaneously is long, laborious, and produces a moderate degree of hyperimmunity only.

The virus-producer is placed in stocks at a level of 1·5 metres above the ground. The animal to be hyperimmunized is placed in stocks at ground level. The blood passes direct from the jugular of the former to that of the latter through a rubber tube armed with a trocar at each end. Three to four litres are allowed to pass. According to the author no complications arise.

[Experiments of this type carried out at Muktesar, India, a few years ago were not so free from complications.—A. L. S.]

VAN SACEGHEM (René). **Étude sur la Production du Serum contre la Peste bovine.** [The Production of Anti-Rinderpest Serum.]—*Bull. Agric. Congo belge.* 1921. Sept. Vol. 12. No. 3. pp. 495–497.

The greater part of this short note is a repetition word for word of another note appearing a few pages earlier in the same number of the journal [*vide supra*].

Hyperimmunization having been carried out by direct transfusion, the animal is bled to the extent of 2–3 litres on the 10th, 14th, 18th and 21st days. It is then left for a month.

The blood is allowed to clot and the serum decanted at 24th, 48th, 72nd and 96th hours. Three litres of blood yield 2 of serum. Carbolic acid is added in the proportion of 0·5 per cent.

VAN SACEGHEM (René). **L'anaphylaxie dans l'Hyperimmunisation des Bovidés contre la Peste bovine.** [Anaphylaxis in the Hyperimmunization of Cattle against Rinderpest.]—*Bull. Agric. Congo belge.* 1921. Sept. Vol. 12. No. 3. pp. 498–501.

In spite of what this author has said regarding the absence of complications in the process of hyperimmunizing by direct transfusion (see above), in this note he states that symptoms of greater or less severity attributable to anaphylaxis are seen with regularity. These symptoms have never been observed during the first hyperimmunization of an animal which has been vaccinated or has recovered from a natural attack, but very frequently during subsequent hyperimmunizations by transfusion. He draws the conclusion that one of the factors in the causation of the symptoms of anaphylaxis is the large amount of antibody present in the serum, and the other is virus and probably toxin. Anaphylaxis is said to be produced when the relationship between virus and antibody is disturbed. In natural cases of infection antibodies are produced during the attack, when antigen is present in large quantities. The neutralization occurs progressively, and antigen is present in larger amounts than antibody. When recovery takes place the small amount of antibody neutralizes the virus and toxins which progressively lose their virulence. Antibodies only appear in more or less considerable quantities when the virus and toxins have disappeared. On the other hand, when antigen is less in amount than antibody the symptoms of anaphylaxis are produced.

It might be objected that when 3 or 4 litres of virus are transfused antigen is in excess, but the author explains that the massive dose of virus is in reality a repetition of small doses, and thus in a sense the antibody is in excess. He holds that this explanation of the occurrence of the symptoms is supported by the fact that when virus is injected subcutaneously anaphylactic symptoms are not produced. The virus is absorbed slowly from the subcutaneous " pocket," but only after it has been acted upon there by the circulating antibody—the antigen being locally in excess.

The conclusion is drawn that the first hyperimmunizing dose should be given by transfusion and subsequent ones by subcutaneous injection.

Appendix.

The author states that further observations compel him to make a correction in the foregoing, but that the correction goes to strengthen his argument with regard to the causation of the symptoms of anaphylaxis. The correction is that anaphylactic symptoms are frequently produced when the first hyperimmunizing transfusion is given to recently vaccinated or recovered animals. Such symptoms are avoided if an interval of six months is allowed to elapse between vaccination (or recovery) and transfusion. Diminution in the amount of antibody is given as the explanation of this.

Injections of 5–10 cc. of sulphuric ether into the jugular has cut short anaphylactic symptoms which had the appearance of proving fatal.

VAN SACEGHEM (René). **La Vaccination contre la peste bovine.** [Vaccination against Rinderpest.]—*C.R. Soc. Biol.* 1921. Nov. 12. Vol. 85. No. 32. pp. 878–879.

As a result of six months' experience, the author has arrived at the conclusion that the simultaneous method gives very uncertain results, and to replace it has devised the method of giving 0·1 cc. of virus, followed on the second day of the febrile reaction by an intravenous injection of 50 cc. of serum.

In this way the risk of neutralizing the virus is overcome, and by injecting the serum when the animal begins to react to the virus, valuable assistance is given to it.

KÉMARD. **Essais de vaccinations antipesteuses par la procédé Gordziaklowski.** [Vaccination against Rinderpest by Gordziaklowski's method.]—*Rec. Méd. Vét.* 1922. Jan. 15. Vol. 98. No. 1. pp. 23–27.

The method is based upon the possibility of attenuating the virus by heating it to 55° C. This constitutes the first vaccine, in a dose of 1 cc. The second vaccine is simply 2 cc. of defibrinated or citrated blood given 12 days later.

The author has tested the method in 245 animals, and concludes that the method is not of any value. The first vaccine produced no reaction and the " infecting " dose was responsible for a number of deaths. He suggests that the attenuation of the first vaccine was carried too far.

CURASSON (G.). **Les insectes piqueurs peuvent-ils transmettre la peste bovine.** [Can Blood-Sucking Insects transmit Rinderpest?]—*Rev. Gén. Méd. Vét.* 1922. Feb. 15. Vol. 31. No. 362. pp. 57–60.

The small number of experiments recorded in this paper were carried out by the author in Poland with a view to determining whether blood-sucking parasites play any part in the transmission of rinderpest.

Ixodes ricinus and *Tabanus* (? sp.) were used.

1. An engorged tick was removed on the second day of fever and ground up in salt solution. The liquid was injected into a healthy animal and produced a normal attack of the disease.

2. An engorged tick was ground up an hour after removal. The liquid obtained failed to infect healthy animals in three instances.

It would appear that a tick could not carry the virus over to the next phase. But it has been noted in French West Africa that ticks object to engorging themselves on animals that are seriously diseased, and that they drop off sometimes before they are completely engorged. There is, therefore, a possibility that such a tick might carry the infection if another animal were close at hand for it to go to. It is at least shewn that the saliva of the tick is not immediately fatal to the virus.

Tabanidae.—Ten Tabanids were caught while sucking blood on an animal in the third day of fever. A mash of their proboscides caused infection in a healthy animal (single experiment). When Tabanidae were kept for a quarter of an hour before the emulsion of the proboscides was made, this proved to be incapable of setting up infection (a single experiment).

Negative results were also obtained when there was an interval of three quarters of an hour, when the flies were ground up after removal of the proboscides, and when the excreta of flies was used.

As conditions with regard to isolation during the experiments were not above suspicion, no great importance is attached to the positive results obtained.

Roux (E.), Vallée (H.), Carré (H.) & Nocard (the late). **Résumé d'éxpériences sur la fièvre aphteuse.** [Résumé of Experiments in connection with Foot and Mouth Disease.]—*Rev. Gén. Méd. Vét.* 1922. Jan. 15. Vol. 31. No. 361. pp. 1–4.

In this short paper the authors assemble some of the information acquired in the course of their investigations carried out between 1901 and 1914.

As the virus has not as yet been obtained in culture, it is maintained by passage through young pigs, the virus obtained being kept between the passages at a temperature below 0° C.

Whatever method of inoculation is used the yield of virus is small. Lymph from vesicles, which is contaminated, and serous exudates maintain their full virulence for about three weeks in the refrigerator. In exceptional cases, in which the virus persists for two months, it is found to be much attenuated.

The best source of virus is the blood of infected heifers taken when the temperature is rising. Pigs are not satisfactory in this respect. Anticoagulants are not employed; the blood is defibrinated mechanically.

Sealed ampoules of defibrinated blood will retain their virulence for several months at 0° C., and for two or three months at 1 to 2° C. Flasks with rubber bungs are equally effective for storing the virus.

Accidental contaminations do not appear to act destructively upon the virus, but dilution is destructive.

The lymph contained in bullae has a higher virus content than the blood, but the highest virus content is to be found in the shreds of shed epithelium. Exudate and epithelium remain infective if diluted twenty thousand times. Pericardial effusions will remain infective if diluted a thousand times; while virulent serum ceases to be certainly infective in doses of less than 0·2 cc. even by intradermic and intramuscular inoculation.

Desiccation is not so injurious as has been thought. Lymph dried rapidly in vacuo on slides and left at room temperature has proved virulent for young pigs up to 18 days after. Large quantities of blood serum have been found to retain their virulence from 20 to 105 days. In some cases the period of incubation is prolonged, but when infection does not occur the animal is not rendered less susceptible to an ordinary infection. The same result is obtained when animals are inoculated with lymph and blood which have become non-pathogenic through storage. Excluding intradermic, intramuscular and intravenous inoculation, all the methods of experimental inoculation are far less severe than natural infection. As a rule, experimentally produced foot and mouth disease is shewn only by localized lesions of the buccal mucous membranes. Lesions of the teats and digits are not produced. The authors have taken up the question of immunization, and, as a result of their experiments, use virulent blood serum which has been "stabilized" by keeping in a refrigerator for a month. A dose of not less than one cubic centimetre is injected subcutaneously. Larger doses may lead to undesirable results, and smaller ones may not establish immunity. Some hundreds of animals inoculated in this way have developed slight buccal lesions with the exception of two, which shewed lesions of the teats and feet. The immunity conferred is of brief duration and may disappear within six months.

MATTE (E.) & SANZ (B.). **Quelques essais de vaccination préventive contre la fièvre aphteuse.** [Vaccination against Foot and Mouth Disease.]—*Bull. Soc. Path. Exot.* 1921. Nov. Vol. 14. No. 9. pp. 523–530.

In South America the authors found that the intravenous injection of 20 cc. of citrated blood obtained from an infected animal during the eruptive phase of the disease, as recommended by MOUSSU, was not free from danger. They therefore carried out a number of investigations—on several herds where the disease was in existence—using virulent blood heated to different degrees. The protocols for these are given, and the following conclusions drawn.

1. As a rule far fewer vaccinated animals become infected than controls. In some instances no case of foot and mouth disease occurred among the vaccinated animals. Until a better method is discovered, it appears to be valuable to vaccinate with heated virulent blood.
2. It is sufficient to heat the blood to 58° C. for 15 minutes. The dose is 2 cc., and the inoculation is made subcutaneously.
3. The less favourable results obtained in the earlier experiments were possibly due to the animals vaccinated being already infected.

KERN (H.). **Untersuchungen über die Folgen der Maul und Klauenseuche beim Rind.** [The Sequelae of Foot and Mouth Disease in Cattle.]—*Schweiz. Arch. f. Tierheilk.* 1921. Dec. Vol. 63. No. 12. pp. 505–523.

In animals which have passed through an attack of foot and mouth disease from 6 to 8 months previously signs of healed ulcers can be found on the tongue. These areas are devoid of papillae, and where the tongue is pigmented, of pigment. The lesions of the gums heal up and leave no trace of their existence. Those on the pillars of the stomach are recognizable as brownish areas of various sizes. The evidence of the disease is particularly clearly seen in the feet. Double hoofs are very constantly met with. The inner hoof shows black coloured cleft-like defects which on the outer surface are completely closed. In such cases there have been isolated vesicles on the coronary ring beneath the horn which as a result of growth have been pushed down in the horn. The author thinks that these lesions are of importance in that they possibly represent one of the means by which latent infection is carried.

The milk production may fall by from 10 to 90 per cent. In the observations made it averaged 66 per cent.

The functions of the skin may be disturbed. In 33 per cent. of the animals the coat was not changed even in the summer. Dyspnoea is usually associated with the disturbance of skin functions, and is particularly noticeable when animals are put to work.

Abnormalities in connection with the sexual functions in females, such as nymphomania and failure to conceive in spite of normal periods of heat, are observed. Occasionally the growth of young animals is hindered, and in rare cases the udder becomes defective.

The inoculation material known as " Makla " is certainly beneficial when used sufficiently early, that is to say before symptoms develop, but it is of doubtful value when used after symptoms have made their appearance; in such cases the animals suffered as severely as those not inoculated.

BRIDRÉ (J.) & DONATIEN (A.). **Vaccine et Clavelée.** [Cow-pox and Sheep-pox.]—*Ann. Inst. Pasteur.* 1921. Nov. Vol. 35. No. 11. pp. 718–740.

The authors review at some length the literature dealing with the unity or plurality of variola, cow-pox and sheep-pox, and then detail the experiments which they have performed with a view to determine whether cow-pox and sheep-pox are identical. Variola has not been taken into consideration.

The experiments are grouped under the following headings :—I. Vaccinia in the sheep. Passage of vaccine virus from sheep to sheep. II. Does the inoculation of sheep with vaccine virus confer immunity against further inoculations with the same material? III. Does vaccination confer immunity against sheep-pox? IV. Can cow-pox be transformed into sheep-pox ? V. Is sheep-pox inoculable to species other than the ovine ? Can it be transformed into cow-pox ? VI. Does sheep-pox immunize against cow-pox ?

It is an opinion which may be held, and which the authors are not prepared to contradict, that the viruses of cow-pox and sheep-pox have a common origin. They have not, however, been able to transform either disease into the other. Cow-pox, when conveyed to the sheep, has maintained its own characters. They think, however, that certain conclusions may be drawn from their experiments.

1. Vaccinia is inoculable to the sheep, and sheep can be used for culture *in vivo* in series for the production of vaccine virus.
2. Inoculation with vaccine virus protects a sheep, at least for a time, against a fresh inoculation, provided the first inoculation results in a sufficiently marked reaction.
3. Vaccine virus does not protect against sheep-pox.

4. Sheep-pox does not protect a sheep against vaccinia, and it may be added that the inoculation of other animals with sheep-pox virus does not protect them against vaccine virus.

5. In the authors' experience the two viruses behave as though they were quite different.

GOULAY (M. A.). **Traitons les chiens contre la rage, au lieu de les tuer.** [Should Dogs be immunized against Rabies instead of being destroyed.]—*Rec. Méd. Vét.* 1921. Oct. Vol. 107. No. 19. pp. 561–568.

LELEN (R.). **Contribution à l'étude de la fièvre aphteuse en Tunisie.** [Foot and Mouth Disease in Tunis.]—*Rec. Méd. Vét.* 1921. Nov. 15. Vol. 107. No. 21. pp. 625–639.

LEYNEN (E.). **La epizootiá de peste bovina en Bélgica.** [The Outbreak of Rinderpest in Belgium.]—*Rev. Hyg. y Sanidad Pecaurias.* 1921. Oct. Vol. 11. No. 10. pp. 511–519.

LIGNIÈRES (J.). **La peste bovina.** [Cattle Plague.]—*Revist. Zootéc.* 1921. Mar. Vol. 8. No. 90. pp. 87–98.

PAUL-MAUCEAU (G.). **Vaccination préventive contre la fièvre aphteuse par vaccin non specific.** [Vaccination against Foot and Mouth Disease with Non-Specific Vaccine.]—*Rev. Path. Comp. et Hyg. Gén.* 1921. Sept. 20 and Oct. 5. Vol. 21. No 190. pp. 303–307.

VAN SACEGHEM (R.). **L'anaphylaxie dans l'hyperimmunisation des bovidés contre la peste bovine.** [Anaphylaxis during Hyperimmunization of Cattle against Rinderpest.]—*C.R. Soc. Biol.* 1921. Dec. 10. Vol. 85. No. 36. pp. 1105–1106.

MYCOTIC DISEASES.

BROCQ-ROUSSEU. **Sur la lymphangite épizootique.** [Epizootic Lymphangitis.]—*Rec. Méd. Vét.* 1922. Feb. 28. Vol. 98. No. 4. pp. 84–91.

The author claims that in collaboration with MATRUCHOT he has been able to demonstrate a conidial form of the parasite of epizootic lymphangitis.

Some cultures of the organism obtained from BOUQUET and NÈGRE were left at room temperature, and after several weeks were found to have developed an abundance of white aerial growth. Cultures from this powdery material were made in broth containing 1 per cent. xylose and a mycelial growth developed. On the surface of the broth there was a white " crust " composed of conidial forms.

Subcultures were obtained on various media when the temperature was kept at about 25° C. A parallel series incubated at body temperature failed to grow, or grew to an insignificant extent only. This point is of importance, since the cultures of BOUQUET and NÈGRE developed well at 38°. They, however, had found that at temperatures below 37° the cultures developed a more pronounced downy appearance.

Brocq-Rousseu claims to have produced similar white growths both from various cultures of the cryptococcus and from lesions direct. The determining factor in the production of such cultures is to keep the temperature at about 25° C.

The maximum development of spores on carrot " juice " is obtained when the medium contains 16–20 per cent. of sugar (expressed as reducing sugars). The cryptococcus will not grow on the surface of Sabouraud, but filaments develop in the depth of the medium and by lifting the superficial layer produce an irregular surface. While multiplication proceeds in the depth of the medium, and while there is sufficient moisture, the culture remains greyish yellow or brownish in colour. Subsequently, when the surface becomes desiccated and fissures make their appearance, aerial filaments bearing conidia are developed.

Conidia are very small, pyriform and sessile, isolated or in small groups. The conidiophores are in clusters. These characters indicate that the fungus approximates to the genus *Botrytis*, Micheli and Link.

The author discusses briefly the biological classification of the parasite.

Attention is drawn to the point that so far as Northern Africa is concerned, epizootic lymphangitis exists as an epidemic in those places where the temperature limits are those required for artificial cultivation as described above (20–25° C.). The possibility of insects acting as vectors of the spores is indicated by the fact that multiplication of the parasite takes place on straw and manure.

It has not been found possible so far to stain the cryptococcus selectively. Examination of unstained moist preparations under a cover-glass is advised.

Vaccination appears at the moment to be the method of choice for the treatment of the condition, but the prolonged treatment sometimes necessary is against its application.

MISCELLANEOUS.

WEBSTER (P. J.). **Napier Grass. A Promising New Forage Plant for the Philippines.**—*Philippine Agric. Rev.* 1920. Vol. 13. No. 4. pp. 353–354. With 1 plate.

Napier grass, *Pennisetum purpureum*, is a coarse perennial grass attaining a height of 5 metres or more if left unchecked. It is a native of tropical Africa and was first domesticated in Rhodesia in 1909. It is now grown in the United States, Cuba, Queensland, and possibly elsewhere. In the Philippines it has shown itself well adapted to climate and soil, and to be more drought-resistant than any other forage plant introduced as yet.

In the rainy season it makes a very heavy growth, and while a comparative test has not been made, it is apparent that in yields of green fodder the grass is superior to all other forage plants grown in the archipelago.

In Cuba, Napier grass is reported to yield over 550 tons of green forage per hectare [2½ acres roughly.—Ed.] per year. Seeds are difficult to germinate but cuttings grow readily. Cuttings should be 6–8 inches long and should have one or two joints. Where the internodes are long the topmost joint should be not more than 2 inches below the top end of the cutting.

After ploughing and harrowing, the cuttings should be planted 16–20 inches apart in rows, with a space of about 4 feet between the rows. When material is abundant, whole canes may be laid flat in a shallow furrow and covered with soil. When material is scarce it is better to plant cuttings and push them diagonally into the soil so that the tops are flush with the surface. The grass should not be allowed to grow to more than 2–3 feet high before cutting, as it is liable to become woody.

Depending upon the quality of the soil and the rainfall, six to nine cuttings may be made the year after the plants are established. In places where there is a long dry season planting should be done after the onset of the rains.

The food value of the grass is indicated by the analysis :—

Water	61·81
Protein	2·92
Carbohydrates	17·29
Fat	·29
Fibre	14·77
Ash	2·92

Merker grass, a variety of the same species, is less coarse. Both will stand moderate continuous pasturing when well established.

Cuttings may be obtained by application to the Director of Agriculture, Manila. [It will be interesting to hear whether this grass makes good silage.—A. L. S.]

YAKIMOFF (W. L.) & WASSILEWSKY (W. J.). **Experimentation avec le "Dissodoluargol" de Danysz.** [Experiments with Danysz's "Dissodoluargol."]—*Bull Soc. Path. Exot.* 1921. Dec. Vol. 14. No. 10. p. 640.

The results of experiments carried out with Luargol were reported by the author in the *C.R. Soc. Biol.*, April 27, 1917.

The new drug has the advantage of being water-soluble if mixed with soda.

Mice infected with dourine were used, and the active dose was found to be 1 cc. of a 1 in 900 solution for a mouse of 20 grammes. The fatal dose was 1 cc. of 1 in 200 solution. The therapeutic index of the new drug was 1–3·6 (as compared with 1–3 in the case of Luargol). Relapses, when they occurred, were delayed.

WOODCOCK (H. M.). **An Introduction to the Study of Haematophagy. II. Haematophagy as a Pathological Occurrence.**—*Jl. Roy. Army Med. Corps.* 1921. Dec. Vol. 37. No. 6. pp. 418–431. With 2 text figs and 1 plate.

Negri Bodies.—"Among my preparations of the Negri bodies are certain which were kindly given by Negri himself, some years ago . . . . . .

"One of these is an ordinary Giemsa smear . . . The smear is . . . well fixed and stained. But it follows that, from the smear alone, it cannot be said definitely what was intracellular, and what was extracellular; where I indicate which, in my opinion, of the two conditions was the case with respect to any particular body, I am having regard also to the situation of the corresponding forms, as seen in sections . . . .

"A regular series of transitions can be found between what are undoubtedly red corpuscles, or corpuscular masses, and fully formed Negri bodies."

PANISSET (L.) & VERGE (J.). **De l'action du Novarsénobenzol chez le chien.** [The Action of Novarsenobenzol on the Dog.]—*Rec. Gén. Méd. Vét.* 1922. Mar. 15. Vol. 31. No. 363. pp. 121–128.

Novarsenobenzol may be injected subcutaneously or intravenously. By the former route very dilute solutions (in distilled water) must be used, as the drug is liable to produce necrosis if concentrated solutions are introduced into the subcutaneous tissue. For intravenous injection concentrated solutions may be employed, but care must be taken that the whole dose passes into the vein and that none escapes into the perivascular tissues. The minimum toxic dose for the dog is, as in the case of the human subject, 15 cgm. per kilo body-weight.

Five centigrammes per kilo was found to be too large for therapeutic purposes, and the therapeutic dose was therefore fixed at 2 cgm. It was thought advisable to give this in two halves at an interval of a day. If a single dose is to be given, the 2 cgm. may be injected at one time. If, however, repeated doses are to be given, it is better to use dilute solutions (at least 1 in 20) and to give two doses of 1 cgm. on consecutive days, leaving a day's interval before proceeding to the next two injections.

Immediately after injection there may be symptoms indicative of intolerance, such as slight dyspnoea and temporary dullness. On numerous occasions injected dogs have been observed to stretch themselves and yawn. Frequent vomition and more or less violent expulsive efforts, resulting in copious defaecation, may be observed at first, but these symptoms soon disappear.

The injection of novarsenobenzol is followed by a marked rise of temperature without upsetting the animal in any way. With doses of 5–10 cgm. this febrile reaction may last for more than 24 hours.

When repeated doses are given a certain degree of tolerance is established, which results in the practical disappearance of the symptoms described.

When doses of from 5–10 cgm. per kilo are given repeatedly a marked improvement in condition is brought about. But parallel with this there are certain symptoms which show that the toxic dose is being approached. The first of these is the presence of albumen in the urine. There is always a marked amount of albumen in the urine after the injection of novarsenobenzol, which tends to disappear in the intervals between injections, to reappear immediately a fresh dose is given. In a number of cases bile pigments can be demonstrated in considerable amounts in the urine.

The eyes are particularly susceptible to novarsenobenzol, and after a single dose of 15 cgm. per kilo complete blindness may result.

The most important local effect produced by the injection of novarsenobenzol is necrosis of the tissue when a too concentrated solution is employed. The local irritant action of the drug depends entirely upon the concentration used.

For subcutaneous injections only dilute solutions (not exceeding 5 per cent.) should be used, and if stronger solutions are employed for intravenous injections the utmost care must be taken to prevent any escaping from the vein to the connective tissues. Should some escape and set up severe disturbance there, obliteration of the vein follows.

Coagulation of the blood is retarded by the drug, in one instance blood taken from the saphena vein " some time " after the injection remained liquid for more than 24 hours.

No precipitation has been observed when novarsenobenzol and serum have been mixed *in vitro*, such as had been observed in human practice.

ALLEN (H.). **An Indian Liquorice-poisoning Experiment.**—*Vet. Jl.* 1922 Feb. Vol. 78. No. 2. pp. 58–59.

SINCLAIR (J. M.). **A Short History of the Infective Diseases amongst the Domestic Animals of Southern Rhodesia since the Occupation.**—*Rhodesia Agric. Jl.* 1922. Feb. Vol. 19. No. 1. pp. 10–20.

REPORTS.

UNION OF SOUTH AFRICA. **Annual Report of the Department of Agriculture for the Year ended June 30th, 1921.**—From the *Jl. Dept. Agric.* 1922. Jan. Vol. 4. No. 1.

ANNUAL REPORT OF THE SECRETARY FOR AGRICULTURE.

Services of Veterinary Surgeons to the Public:—

" A system of payment for veterinary services for the treatment of of non-scheduled diseases has been introduced, and a veterinary surgeon will be expected to attend to non-scheduled cases if his more important work permits. It is hoped that in the course of time the reception of the scheme by the public will be such as to indicate that private veterinarians are able to practise their profession in a number of districts."

Scab in Sheep and Goats.—Progress in the eradication of these diseases is slow, the main difficulty being apparently that the responsibility for eradication is thrown on the department instead of on the owners. The time seems to be ripe for legislation of a more drastic character.

East Coast Fever.—In the Transkeian Territories about two-thirds of the districts are infected. In Natal 27 out of 43 districts are infected, and in the Transvaal 6 out of 25. The value of dipping is being more appreciated, and the erection of dipping tanks is being pushed with greater speed than last year.

Anthrax.—Outbreaks are numerous and widespread. Importance attaches to this in view of the value of skins and hides exported.

Nagana.—Further land settlement in the neighbourhood of the game reserve in Zululand has been rendered impossible owing to losses among cattle from nagana. The establishment of a Veterinary Research and an Entomological station in Zululand is in progress.

REPORT No. II. VETERINARY DIVISION. [BORTHWICK (J. D.).]

East Coast Fever.—In some districts there is a diminution and in others an increase. In the Pretoria area the increase is from 27 to 87 infected farms. These form a continuous block, the disease spreading gradually from farm to farm. Overlapping of cattle is the main cause. Dense bush and the absence of fencing render the prevention of this impossible. The number of tanks erected has increased from 126 to 258, and 110 are under construction.

Tuberculosis.—Pressure of other work and lack of funds has prevented this from being taken in hand properly.

Anthrax.—The continued prevalence is largely due to concealment of cases in native-owned herds for the sake of the hide. The new spore vaccine is giving good results.

Epizootic lymphangitis.—Eight of the ten outbreaks in the whole province were in the Bathurst and Humansdorp areas.

Dourine or Slapziekte.—Is chiefly confined to the Cape Province, but one outbreak occurred in the Transvaal. Its presence in the Orange Free State is suspected. It is very widespread in Griqualand West and British Bechuanaland. In these areas 39 outbreaks, involving 3,270 animals, occurred. A great factor in the spread of the disease is the concentration of mobs of horses at high altitudes to escape horse sickness.

REPORT NO. III. VETERINARY EDUCATION AND RESEARCH.

[DU TOIT (P. J.).]

Horse Sickness.—Inoculations of mules were carried out in the districts to the number of 2,847. The mortality was 1·89 per cent. The causation of staggers in inoculated horses is still under investigation, but nothing has been discovered to disprove the theory that it is due to some latent infection quite distinct from horse sickness.

In Griqualand West the disease was particularly severe throughout the year. Observations indicated that mosquitoes were not the sole, or even the chief, transmitters in this case. On many farms the disease spread like a contagious disease.

Lamziekte in Cattle.—Attempts are being made to find an efficient and cheaper substitute for bone meal manure. The results indicate that a manure rich in phosphorus prevents pica. A pica survey of the whole Union is being undertaken in conjunction with the Botanical Survey Committee.

Contagious Abortion of Cattle.—Experiments confirmed the previous conclusions that satisfactory immunity can only be established by the use of live vaccine.

Anthrax.—Satisfactory results have been obtained from the use of the new spore vaccine. Although forms asking for certain particulars were sent out with each supply of vaccine, only 5 per cent. of these were returned. It is concluded that had the results been unsatisfactory in the remaining 95 per cent. of cases the Department would have heard about it. The vaccine appeared to affect dairy cows adversely as regards milk yield, and a new vaccine to overcome this difficulty is being prepared. Further, the use of the vaccine caused a local swelling (which was rarely followed by fatal results), but owners are now accustomed to this and do not object; in fact the degree of swelling is taken as some guide as to the degree of immunity.

Quarter Evil.—In some cases it appeared that the vaccine did not yield a degree of immunity sufficient to protect against the local virus. In such cases vaccine was prepared from the muscle of an animal dead in the district and used for that particular outbreak.

Attempts are being made to prepare a liquid vaccine, as there is a risk that animals may get too much or too little muscle powder held in suspension in a liquid.

CANADA. **Department of Agriculture. Report of the Veterinary Director-General, for Year ending March 31 1921.** [TORRANCE (F.), Veterinary Director-General.]—Ottawa: F. A. Acland.

The change from ranching to farming in Alberta has rendered it possible to stamp out cattle mange there. This area has been under restrictions since 1904, but it has only been since fencing of farm lands, and enclosure of pastures has been carried out that success has been attained. Dipping tanks were erected and so placed that no animal had to travel more than 12 miles to be dipped. Dipping was carried out on June 24 and July 2, and all movements of cattle were suspended during the dipping period, and heavy penalties were prescribed for those who neglected or refused to dip their animals. So carefully had the details of the scheme been worked out, and so thoroughly was it carried out that it resulted in the complete eradication of the disease, "so that there is now no mange area in Canada for the first time for 26 years."

The organization of the scheme for the simultaneous dipping of all cattle in the mange area in Alberta (comprising 74,952 square miles) was as follows.

The area was divided into districts, each of which was placed under the charge of a Veterinary Inspector with range riders to assist him.

The districts were subdivided and committees of stock owners chosen for each. These committees were instructed in their duties at a series of meetings throughout the area. These committees did the work of compiling lists of owners and the number of their animals, with their location, and the number and situation of the tanks.

The members of the owners' committees were detailed for separate duties as follows :—

1. Seeing that the tanks (or vats as they are termed in the Report) were in proper order.
2. That adequate supplies of lime and sulphur were at hand.
3. Supervision of the gathering of the cattle.
4. Proper control of the animals between their dippings.
5. Supervision of the preparation of the dip.
6. Supervision of the working of the vat, and maintenance of the vat at the correct temperature.
7. Keeping records.

Tuberculosis.—The accredited herd plan was put into operation in September, 1919, and applications for herds to be tested are very numerous.

The cleaning up of an infected herd is not a simple matter . . . . . Experience proves that an advanced case and an incipient case may fail to react. The incipient case will be detected when tests are repeated (after 60 days), but the advanced non-reactor is a more difficult problem. Occasionally an advanced case may survive several tests and remain a source of infection in the herd.

The final test before a herd becomes accredited is carried out a year after a completely clean test has been obtained. Animals which it is desired to import into the herd to make up for those destroyed, must pass a test before they can be brought on to the farm, and must then be isolated for 60 days and pass a second test before they can be admitted to the herd.

" This adds very greatly to the work of our inspectors, and as we advance will still further impede our progress. We appear to be dragging a chain which lengthens at every step. Relief will be in sight when we have a list of fully accredited herds from which purchases can be made, and when the time arrives for turning over the herds which have been fully accredited for one year to the future control of an approved practitioner."

In the tests carried out under the accredited herd plan, 15·88 per cent. of reactors were detected.

BENGAL. **Annual Report of the Bengal Veterinary College and of the Civil Veterinary Department, Bengal, for the year 1919–1920.**—Calcutta: Bengal Secretariat Book Depot. 1920. [Price As. 12.]

CEYLON. **Report of the Government Veterinary Surgeon, for 1920.** [STURGESS (G. W.), M.R.C.V.S.]—1921. 6 pp. Colombo.

MADRAS. **Annual Administration Report of the Civil Veterinary Department, Madras Presidency, for 1920–1921.** [AITCHISON (D. A. D.), I.C.V.D., Principal.]—1921. 20 pp. Madras: Supt. Govt. Press. [Price As. 2.]

NORTH-WEST FRONTIER PROVINCE. **Report of the Civil Veterinary Department for the year 1920–21.**—Peshawar: North-West Frontier Province Govt. Press. [Price As. 13.]

UNITED PROVINCES. **Annual Report of the Civil Veterinary Department, United Provinces, for the year ending March 31 1920.**—Allahabad: Printed by the Supt., Govt. Press, United Provinces, 1920. [Price As. 11.]

BOOK REVIEW.

EDMONDS (C. R.) [M.R.C.V.S., Assistant Chief Veterinary Surgeon, Rhodesia]. **Diseases of Animals in South Africa.**—pp. xi + 477. With 35 text figs. Demy 8vo. 1922. London: Baillière, Tindall & Cox, 8, Henrietta Street, Covent Garden. [Price 25*s.*]

"The cause that led to the attempt of this work was the feeling that there was need for a book dealing with the more serious diseases affecting farm animals in South Africa as distinct from other lands.

"The admirable works dealing with animal diseases in other parts of the world, and to which we in South Africa are greatly indebted, do not treat the diseases peculiar to this subcontinent in a manner, if at all, in which they have been chronicled from actual experience in this country by a number of veterinary surgeons and other writers in our agricultural press."

These are the opening paragraphs of the preface to the volume under review and they lead one to anticipate finding within it a masterly summary of the practical experience of the man on the spot and a full and up-to-date account of those diseases which, if not peculiar to South Africa, may certainly be said to have their home there.

These anticipations are scarcely realized, for the tick- and fly-transmitted diseases and those due to ultravisible viruses occupy only a small fraction of the volume. The author has not confined himself to his self-imposed limits, but has given descriptions of diseases which have a very wide distribution, such as strangles, pneumonia, mammitis, actinomycosis, navel ill, tetanus, anthrax, black quarter, tuberculosis, and so on. Diseases caused by worms and other metazoan parasites which occur in practically all parts of the world are also dealt with. The volume is in fact a brief treatise on the diseases of domesticated animals. Those diseases, of which the author's experience must be very extensive are very briefly described. One would have expected a wealth of practical detail in the accounts of the tick-borne diseases but this, unfortunately, is not found. For example, the whole subject of dipping is dealt with in a few generalizations scattered here and there in the text.

The author acknowledges his indebtedness to writers in the agricultural press in South Africa and to certain standard textbooks on the subjects of diseases of domesticated animals and parasitology, but fails to mention at least one source from which he seems to have derived help. Members of the Post-Graduate Courses, held at the Royal Veterinary College, will recognize that the author has made a free use of the notes of the lectures given there.

The general get-up of the volume, printing and reproduction of illustrations, reflect credit upon the publishers.

A. Leslie Sheather.

TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY BULLETIN.

Vol. 10.] 1922. [No. 3.

DISEASES DUE TO PROTOZOAN PARASITES.

Glaser (R. W.). **A Study of** *Trypanosoma americanum*.—*Jl. Parasit.* 1922. Mar. Vol. 8. No. 3. pp. 136–144. With 4 plates.

The author has been led to restudy *T. americanum* as a considerable amount of work has been done on trypanosomes and allied genera since the publication of Crawley's article in 1912. During October, November and December, 1921, the author examined a number of cows and heifers by the cultural method, using Crawley's technique (*i.e.*, 6 cc. of defibrinated blood from the animal to be tested with 6 cc. of broth on the top, the tubes incubated at room temperature). Between October 15 and November 8 positive results were obtained with the blood of 7 animals out of 15 tested. Thirteen samples of blood from different animals taken between November 12 and December 10 all yielded negative results.

Very satisfactory results were obtained with N.N.N. medium prepared with either cow or horse blood. In this medium multiplication is very rapid during the first four or five days. The method is therefore useful for studying dividing forms. A necessary precaution is to moisten the surface of the medium with sterile serum every few days, or to keep the cultures (made in Petri dishes) in a moist atmosphere. On this medium growth is diffuse and not in the form of colonies. The technique of fixing and staining preparations most extensively used was wet fixation in alcohol and ether in equal parts for 15 minutes, followed by staining with Novy's modification of Romanowsky. Certain details were best studied by using Schaudinn's fixative, followed by iron haematoxylin.

Cultures are best studied after three days at room temperature. In these the parasites are found to have nearly cylindrical but curved bodies. The undulating membrane is visible for only about one-third of the body length at the anterior end. The flagellum is as long as or longer than the body. There is a parabasal body near the posterior end of the flagellum, but no blepharoplast is visible. The nucleus is central or anterior to the central point of the body. There is usually a distinct karyosome. The body may contain many deeply stained granules. In some cases no nucleus could be found with certainty in films containing numerous well-stained specimens. By the eighth day nearly all the parasites have lost their undulating membranes, the body appears to be rigid and the nucleus anteriorly placed. A fourteen-day culture in ox blood shews bulbous forms, and round or oval forms, these latter without any flagellum.

After 20 days cultures begin to die off. As already mentioned, multiplication is more rapid on solid media, and the life of the parasites is correspondingly shortened. Degeneration forms are marked by the ninth day. Although amoeboid-looking forms are seen, no actual amoeboid movement has been observed. Experimental inoculations with guinea-pigs, rabbits and mice confirmed CRAWLEY's observation that the trypanosome is specific for cattle.

The insects found in the largest numbers around the cattle were *Stomoxys calcitrans*, *Haematobia serrata* and *Musca domestica*. A large number of specimens of each of these species was examined for trypanosomes, but with entirely negative results. *Herpetomonas muscae-domesticae* was frequently found in the house-flies.

Experimental feeding of Stomoxys and Haematobia showed that the trypanosome was still alive, but considerably modified after 24 hours. After 48 hours the existence of the flagellate was doubtful.

In view of NÖLLER's recent contention that the genus Crithidia is a synonym for Trypanosoma, experiments were carried out with a view to testing whether true trypanosomes could be obtained in the cultures from the crithidial forms by subjecting the plates to changes of temperature as indicated by NÖLLER. No true trypanosome forms were obtained. The author has never seen the parasite in true trypanosome form. A specimen found by examination of sediment of centrifuged blood containing the parasite was morphologically like those obtained in cultures.

Although the parasite is morphologically a Crithidia, the author prefers not to alter its designation as a trypanosome for the reasons that: (1) The true Crithidia inhabit the alimentary tract of invertebrates; (2) since the parasite occurs in the blood of cattle it seems best to regard it as an intermediate evolutionary form between the true crithidians and true trypanosomes; (3) the parasite has remained in the genus Trypanosoma for so long.

TALIAFERRO (W. H.) & TALIAFERRO (L. G.). **The Resistance of Different Hosts to Experimental Trypanosome Infections, with Especial Reference to a New Method of measuring this Resistance.**—*Amer. Jl. Hyg.* 1922. May. Vol. 2. No. 3. pp. 264–319.

The authors point out that there are four types of life-histories of trypanosomes in vertebrate hosts: (1) Non-pathogenic trypanosomes, such as *T. lewisi* in the rat. This trypanosome undergoes multiplication in the rat's blood for a period of 22 to 32 days. Multiplication then ceases, but trypanosomes remain very plentiful in the blood for a further period ranging from 7 to 100 days. After this the so-called adult forms disappear and the rat is immune. (2) Pathogenic African trypanosomes, such as *T. brucei* and *T. rhodesiense*, when grown in rats and mice exhibit a continuous type of infection, multiplication going on until the host dies. (3) The same trypanosomes when inoculated into guinea-pigs, dogs, etc., exhibit a relapsing type of infection, characterized by alternating periods of increase and decrease of parasites in the blood. (4) There is at least one species of trypanosome which does not reproduce in the blood at all, but in the tissues (*T. cruzi*).

These differences may be explained by assuming a peculiar type of constitution either in the parasite or the host. The life-history of *T. cruzi* is probably explained by the first assumption, the trypanosome being in reality a tissue parasite. In the other cases the underlying cause appears to be a condition (permanent or temporary) of the host.

The authors consider any of the conditions which are adverse to the parasite as "resistance," whether it be direct, as a result of special activity on the part of the host, or in any manner indirect. *T. cruzi* is not considered in this paper.

Any resistance to infection may result either in retarding multiplication or in destruction of the forms produced. A fairly accurate idea of the total resistance may be obtained by making daily estimations of the number of trypanosomes present per cc. If, however, means could be devised by which a measure of the rate of multiplication or the rate of destruction could be determined, the two types of resistance could be differentiated. The authors have attempted to devise means of determining comparatively the rate of multiplication, based upon the difference in variability in size of individuals taken from a population of trypanosomes undergoing rapid multiplication and from a population undergoing little or no multiplication.

The authors have adopted the method of obtaining a coefficient of variation which measures the deviation in percentages from the mean, and have used the coefficient of variation for the total length.

Working on these lines they found that in rats infected with *T. lewisi* the arrest of multiplication and the later disappearance of trypanosomes are due to a resistance, the essence of which is a retardation of multiplication. Just as their resistance is reaching its maximum, the host suddenly develops a resistance which kills off most of the parasites in the blood. Those which remain persist for a variable length of time and are finally killed off suddenly.

In mice and rats infected with pathogenic trypanosomes the opposite condition is found to hold. No evidence of resistance on the part of the host leading to retardation of multiplication can be found. In some instances multiplication became more rapid as the infection progressed.

In the relapsing type of infection, such as that produced by pathogenic trypanosomes in dogs, no evidence could be found of a resistance being developed by the host resulting in a retardation of multiplication, but a resistance is developed which destroys a large number of the parasites after they are formed. "The fact that resistance in the non-pathogenic *T. lewisi* produces two different effects, whereas resistance in pathogenic species (if present at all) produces only one of these effects, indicates that in the non-pathogenic forms there is either an entirely different type of mechanism of resistance, or that there is a different type of mechanism superimposed on the mechanism found in the pathogenic forms. It is interesting to note that Miss ROBERTSON (1912) has brought forward considerable evidence to show that in *T. gambiense* in the monkey there is an endogenous cycle, in which phases of active reproduction alternate with phases of little or no reproduction. If this be true, it would indicate that this form in the monkey encounters much the same type of resistance as *T. lewisi* in the rat, except that in the latter case when reproduction ceases it never starts again. Miss ROBERTSON's results indicate that *T. gambiense* in the monkey encounters a resistance midway between the type we have described in *T. lewisi* in the rat and the pathogenic species in the guinea-pig. Such a result would not be at all surprising, and with the growing evidence that *T. gambiense* can exist in certain mammals as a non-pathogenic parasite it may be possible to find a host in which this trypanosome encounters the same type of resistance as *T. lewisi* in the rat."

DAHMEN (H.). **Die Serodiagnostik der Beschälseuche.** [The Serum Diagnosis of Dourine.]—*Arch. f. Wissen. u. Prakt. Tierheilk.* 1922. Mar. Vol. 47. No. 5. pp. 319–353.

The author has employed the following methods in the serum diagnosis of dourine:—deviation of the complement using watery and alcoholic extracts as antigen, agglomeration, macroscopic agglutination, precipitation, and lipoid fixation reaction. The paper also contains accounts of experimental treatments with various drugs.

It was found that alcoholic extracts were superior to watery extracts as antigen. The trypanosomes used for making the extracts were obtained by bleeding out rats infected with *T. equiperdum* shortly before death.

The strain of *T. equiperdum* used was apparently one isolated during an outbreak of dourine in Prussia. In a comparative set of tests the alcoholic (alcohol-aether) extract appeared to be about six times as effective as the watery (carbolized salt solution) extract.

In a not inconsiderable number of cases the results appeared to indicate that when plaques appeared the amount of antibody present in the serum decreased. A persistent reduction in the amount of antibody associated with the appearance of fresh clinical symptoms appeared to indicate a bad prognosis.

Repeated injections of trypanosome extracts or rat blood containing trypanosomes into rabbits was found to cause distinct variations in the antibody content of the rabbits' serum.

The specific nature of the complement deviation obtained with dourine horses was tested by carrying out tests with sera from a number of horses affected with glanders, epizootic lymphangitis, infectious anaemia and strangles, horses immunized against swine erysipelas, and a number which gave positive serum tests for equine contagious abortion. In no case was a positive result obtained.

With a view to ascertaining whether the antibodies present in dourine sera would react with other extracts, a number of experiments were carried out in which the following were used: extracts of hearts and spleens of rats dead of dourine, hearts of healthy rats, various extracts of hearts with and without cholesterin, extracts of glanders bacilli, paratyphoid bacilli, colon bacilli, and Bang's bacillus.

In all cases negative results were obtained, save in those in which the organs of infected rats provided the antigen.

A few agglomeration tests showed that positive sera give agglomeration within five minutes. Agglomeration requiring a longer time is not specific. No details of the technique employed for this test are given.

Owing to the spontaneous clumping of trypanosomes the author did not proceed with the macroscopic agglutination test.

The precipitin test was found to be far inferior to the deviation of the complement test. In four sets of experiments the percentage of dourine sera failing to give positive reactions ranged from 10 to 27 per cent.

The Sachs-Georgi reaction entirely failed to distinguish dourine sera from any others. Lipoid fixation is more reliable than complement deviation, but it is most important that the sera must be rendered absolutely clear by centrifugation. The lipoid fixation reaction does not vary as does the deviation of the complement test; it is also far more accurate in cases which have been under treatment.

Treatment was carried out with neosalvarsan, silversalvarsan, Bayer " 205," and neosilversalvarsan. Neosalvarsan was given in doses of 12 gm., and two doses were given at an interval of 8 days. Good results were obtained in six cases.

Silversalvarsan is likely to cause abortion in pregnant mares, and in some animals trembling of the back and limbs may be observed after an hour or two. Twelve animals were treated with this drug, 10 gm. being given in doses of 4, 2 and 4 gm. at intervals of 8 days. Excellent results were obtained.

Bayer " 205."—Five horses received a total of 15 gm. in doses of 4, 4, 4 and 3 gm., and five were given 20 gm. in doses of 4, 4, 4, 3, 3 and 2 gm.

The results were apparently as good as those obtained with the above drugs, but the animals treated with Bayer " 205 " were not able to work so well as those treated with salvarsan and became fatigued more rapidly.

The results obtained with silversalvarsan will be reported later.

Twelve foals of dourine-infected mares were tested (method not stated), and two gave positive results. At three months old these failed to react and they never showed any symptoms.

SANI (L.). **Il Morbo Coitale Maligno in Italia ed i diversi metodi di diagnosi sperimentale.** [Dourine in Italy and the Various Methods employed for Diagnosis.]—*Clin. Vet.* 1922. Feb. 16 & 28. Vol. 45. No. 3. pp. 87–94 ; Mar. No. 4. pp. 121–145.

The author has found the following tests to be useless : The biological test (animal inoculation), thermoprecipitin, aspecific precipitation, Yorke's reaction, the protective properties of the serum against other trypanosomes, Wassermann reaction, injection of adrenalin, the examination of the urine for sugar.

The following methods have a positive value : The discovery of the parasite, precipitation, Lange's reaction, deviation of the complement where that is positive. The question as to which of the serological tests is the more important is still doubtful. The autohaemagglutination test, the intra-palpebral and the subcutaneous vulvo-reaction (with reservations regarding the antigen content of the material used) have a relative value.

VAN SACEGHEM (R.). **Le pouvoir attachant du** *Trypanosoma congolense-pecorum* **variété** *ruandae*, **pour les hématies.** [The Power of attaching itself to Blood Corpuscles possessed by *T. congolense-pecorum* var. *ruandae*.]—*Bull. Soc. Path. Exot.* 1922. Apr. Vol. 15. No. 4. pp. 203–204.

In moist preparations of blood containing this trypanosome it is remarkable that a large number of the parasites are found attached to the red corpuscles by their anterior extremity, and that they are unable, or scarcely able, to detach themselves. When fresh defibrinated blood containing the trypanosome is placed in simplified Novy medium, it is found that after a lapse of 24 hours the parasites are quite free from the corpuscles and move about freely among them. The author believes that this is due to the trypanosomes having lost the power of attaching themselves to the corpuscles, and not that the corpuscles have lost the power of keeping the parasites attached to them.

The loss of power is associated with the appearance of evidence of degeneration in the parasites.

After several days in Novy medium the trypanosomes become agglutinated.

The author thinks that while *T. cazalboui* var. *vivax,* a very actively motile trypanosome, does not become attached to corpuscles, the trypanosome specially referred to in this paper, the motility of which is very restricted, attached itself to the corpuscles in order to be carried rapidly to all parts of the body.

CARPANO (M.). **Sulla piroplasmosi equina in Italia.** [Equine Piroplasmosis in Italy.]—*Clin. Vet.* 1922. Apr. Vol. 45. No. 5. pp. 187–203.

The author has carried out some experiments with blood containing *Nuttallia equi* and *Babesia caballi* either separately or together. He finds that while the blood of a horse which is actually suffering or has recovered from nuttalliosis is infective for a susceptible animal and non-infective for one immune to that infection, the blood of an animal which has recovered from a Babesia infection is not infective for a susceptible horse.

Parallel results were obtained when blood containing both parasites and when blood from an animal which had recovered from the double infection was used for inoculation.

Rhipicephalus bursa, which is the transmitting tick of Nuttallia, is a two-host tick. The infection is gathered by the larva or nymph and transmitted by the adult.

Margaropus annulatus, which is responsible for the transmission of Babesia, is a single host tick. The infection in this case is passed through the egg.

LAGRANGE (E.). **Contribution à l'étude des piroplasmes des bovidés.** [The Bovine Piroplasmoses.]—*Bull. Soc. Path. Exot.* 1922. May. Vol. 15. No. 5. pp. 295–299.

At Nha-Trang, in Indo-China, *Theileria mutans, Piroplasma bigeminum* and *Anaplasma marginale* occur in cattle, the first very abundantly and the last two but rarely.

The buffalo is fairly frequently affected with *Theileria,* or better *Gonderia, mutans,* and a single case of piroplasmosis, due to a parasite of the *bigeminum* type has been detected by SCHEIN. An account of this has already been published.

In an experiment carried out by the author he succeeded in transmitting *T. mutans* from a buffalo to a number of calves, and he concludes that the parasites of the two species are identical.

The author inoculated three young buffaloes with blood containing parasites both of the *Piroplasma bigeminum* and of the *Anaplasma marginale* types, but without result. In a single experiment in which blood containing *P. bubali* was inoculated into a calf the result was negative.

Cattle in Annam are very extensively parasitized by *Boophilus decoloratus.* Other species of ticks are not found in them. The author has never been able to find any ticks on buffaloes.

Wild deer act as hosts to ticks belonging to Haemaphysalis, and are sometimes literally covered with them.

BLACKLOCK (B.) & ADLER (S.). **A Parasite resembling** *Plasmodium falciparum* **in a Chimpanzee.**—*Ann. Trop. Med. & Parasit.* 1922. Mar. 31. Vol. 16. No. 1. pp. 99-104. With 1 plate.

The animal in which the parasite was found was an *Anthropopithecus troglodytes* which had had some attacks of diarrhoea and dysentery previously. The illness was first noted on January 1, and the malarial parasites were found on February 4, 1922. Symptoms of ill-health increased, and this was associated with an increase in the number of parasites in the blood. On February 9 a dose of quinine was given, which resulted in a diminution of parasites in the blood, but did not effect a complete clearance. Improvement in condition resulted, but there was a relapse on the 19th. After a short period of recovery the animal died on the 23rd.

The immediate cause of death appeared to be the presence of very large numbers of strongyloid larvae in the lungs. The spleen was not greatly enlarged, but it was dark in colour and harder than normal. The liver was congested, the marrow dark in colour.

Trophozoites and schizonts were found in the spleen together with masses of pigment. There was considerable fibrosis.

The liver contained large quantities of pigment. The bone marrow shewed trophozoites and gametocytes, and coarse pigment.

The same phases were present, but not in large numbers in the blood. Heavily pigmented leucocytes were common.

Morphologically, the parasite was indistinguishable from *P. falciparum.*

Laboratory-bred specimens of *Anopheles costalis* were allowed to feed on the chimpanzee for two successive nights, but when these were dissected no evidence of infection was found. Two human beings inoculated subcutaneously and intravenously with the chimpanzee's blood, when parasites were present in large numbers, failed to become infected. One of these had not had malaria.

GLASER (R. W.). *Herpetomonas muscae-domesticae,* **its Behaviour and Effect in Laboratory Animals.**—*Jl. Parasit.* 1922. Mar. Vol. 8. No. 3. pp. 99-108. With 1 plate.

While making some observations on the habits of blood-sucking flies at a large dairy the author observed that many of the house-flies frequenting the cattle were engorged with blood. Examination showed that the blood was obtained from cows, and it was noted that the flies fed at punctures made by *Stomoxys calcitrans* or *Haematobia serrata.* These observations indicated that house-flies might act as transmitting agents of parasites.

Since no protozoa were found in the biting flies the opportunity offered to examine the protozoa of the alimentary tract of the house-flies.

Three species of flagellates were found, and one of these forms the subject of this paper.

Herpetomonas muscae-domesticae Burnett was by far the most prevalent, and when present was almost always in enormous numbers. In making numerical estimations only those showing the true flagellate form were counted so that errors of possible confusion with other parasites might be avoided.

During the period June to November, a total of 510 flies were dissected. The number parasitized rose from 12·5 per cent. in June to 52 per cent. in August, and fell to 4 per cent. in October. In November, none was found to contain parasites out of 50 examined.

The author was unable to find parasitized flies among those caught in dwellings, but only in those having access to cattle.

From an examination of his preparations the author forms the opinion that the parasite possesses a single flagellum, thus agreeing with LÉGER, PATTON, PORTER, MACKINNON, and WENYON. A deeply staining thread was observed in some individuals running backwards from the kinetonucleus, but the spiral arrangement of this thread described by PROWAZEK could not be made out. Similarly, the cytopharynx described by WENYON was not observed. In no case was a bacterium found within the endoplasm.

The author believes that the Herpetomonas found by him in New Jersey is identical with or closely allied to the species occurring in Europe.

In contrast with the positive results obtained by a number of investigators in Europe and elsewhere, the author failed to infect mice, rats and guinea-pigs with the intestinal contents of heavily parasitized flies.

The author succeeded in obtaining cultures of the herpetomonad by the following procedure. About 200 larvae of the meal moth (*Euphestia küniella*) were rubbed up in a mortar with 25 cc. of sterile Locke's solution. This was filtered through cloth, paper and a Berkefeld filter. The filtrate was mixed with filtered fresh horse serum in the proportion of 1 to 3. The mixture was tubed in small tubes and inspissated at 74° C. Two drops of grasshopper blood were allowed to flow over the surface of each slant, and the tubes were incubated for 48 hours to test for sterility.

Fifteen grasshoppers and two locustids were inoculated with materials prepared from the intestines of heavily parasitized flies, while 15 grasshoppers were kept as controls. In 48 hours practically all the controls were alive and all but one of the inoculated hoppers were dead. The two locustids were alive. Herpetomonads were found in the blood of all three. Tubes of the special medium described above were inoculated from each of the survivors and kept (sealed with wax) at room temperature for seven days. Growth of Herpetomonas was obtained in a number of the tubes and all were sterile for bacteria. The growth was composed of flagellates in dense clumps. The parasites were actively motile in Locke's solution, but their flagella were abnormally long and appeared to hamper them. Otherwise, their morphology was identical with that of the parasites in the flies.

Subcultures on the same medium failed at the second generation. Two mice were inoculated intraperitoneally with primary cultures, but no infection occurred. The idea of using grasshopper blood originated in the known immunity which may be developed in grasshoppers against bacteria, and it was hoped that in this way the bacteria present in the intestines of the flies could be killed off.

MENDELSON (Ralph W.). *Pseudo-Leptospira icterohaemorrhagiae.*—*Jl. Trop. Med. & Hyg.* 1922. May 15. Vol. 25. No. 10. pp. 125–126. With 2 figs.

Although the author has never observed a case of Weil's disease in Siam, he has during the last year examined the kidneys of 1,483 rats, and has found an organism closely resembling *L. icterohaemorrhagiae* in eight of them. Cultures have not been obtained. In smears from the kidney the organism ranges from 5 to 30µ in length and has from one to six curves. No refractile granules have been noted.

A monkey and seven guinea-pigs failed to react to inoculation, although in one of the latter the presence of a similar organism was demonstrated.

The author thinks that the parasite is harmless.

CAUCHEMEZ (L.). **Au sujet du nom spécifique à donner à la Coccidie du Porc.** [The Specific Name of Coccidium of the Pig.]—*Bull. Soc. Path. Exot.* 1922. Mar. Vol. 15. No. 3. pp. 160–161.

The author writes that in Vol. 14, No. 10, of the *Bulletin* he proposed the name *Eimeria brumpti* for this parasite, and he now writes to say that that name should not stand for the following reasons :—

NÖLLER described the parasite as *Eimeria suis* at Hamburg on December 7, 1920, but his description did not appear in print until February, 1921, when it was published in the *Archiv für Schiffs- und Tropen-Hygiene,* Vol. 25, No. 1, p. 32. In January, 1921, there appeared a thesis by DOUWES in which the name *Eimeria debliecki* was given to the organism (see below, p. 102.)

FLETCHER (T. B.) & SENIOR-WHITE (R.). **Surra and Biting Flies : A Review.**—*Report of Proc. Fourth Entomolog. Meeting, Pusa, India, Feb. 7th to 12th, 1921.* pp. 222–235.

FRANCHINI (G.). **Au Suject de la Culture de l'Herpetomonas du** *Pyrrhocoris apterus.* [The Cultivation of the Herpetomonas of *Pyrrhocoris apterus.*]—*Bull. Soc. Path. Exot.* 1922. Mar. Vol. 15. No. 3. p. 161–163. With 1 text fig.

PATTON (W. S.). **Some Reflections on the Kala Azar and Oriental Sore Problems.** —*Ind. Jl. Med. Res.* 1922. Jan. Vol. 9. No. 3. pp. 496–544.

TALIAFERRO (W. H.). **Variation and Inheritance in Size in** *Trypanosoma lewisi.* **I. Life-Cycle in the Rat and a Study of Size and Variation in " Pure Line " Infections. II. The Effects of Growing " Pure Lines " in Different Vertebrate and Invertebrate Hosts and a Study of Size and Variation in Infections occurring in Nature.**—*Proc. Nat. Acad. Sci. U.S.A.* 1921. May & June. Vol. 7. Nos. 5 & 6. pp. 138–143 & 163–168. With 2 figs.

TROUT (C. L.). **Treatment of Trypanosomiasis by Various Methods.**—*Jl. Trop. Med. & Hyg.* 1921. Dec. 15. Vol. 24. No. 24. pp. 321–322.

DISEASES DUE TO METAZOAN PARASITES.

KHALIL (M.). **On the Susceptibility of the Egg Masses of Planorbis to Drying, Chemical Fertilisers, etc., and its Bearing on the Control of Bilharzia Disease.**—*Jl. Trop. Med. & Hyg.* 1922. Mar. 15. Vol. 25. No. 6. pp. 67–69.

As the Egyptian snails were not obtainable, it was decided to experiment with *Planorbis corneus* (from the ponds at Hampstead). This snail is larger than *Planorbis boissyi*, but is similar in its habits.

The egg masses were exposed to drying in the shade at temperatures ranging from 62° to 72° F., and were also placed in solutions of chemical substances for definite periods.

The stage of development which the egg has attained does not influence the period for which it will resist desiccation. The minimum period of dryness found to be effective was five hours. In no case did this period fail to be fatal.

A 1 per 1,000 dilution of crude ammonium sulphate fertilizer proved invariably fatal in a minimum period of six hours. A solution of one-fifth of this strength was fatal in 20 hours.

The adult snails were killed by three days' dryness, and 24 hours' immersion in 1 per 1,000 ammonium sulphate fertilizer proved fatal.

CAWSTON (F. G.). **Bilharzia Infection in the Pool, the River, and the Lagoon.**—*Jl. Trop. Med. & Hyg.* 1922. Jan. 16. Vol. 25. No. 2. pp. 16–18.

In this short paper the author draws attention to the value of ducks in keeping pools free from freshwater snails, and states that copper sulphate in 1 in 500,000 strength destroys the majority of snails. In the lagoons of Natal many snails have been collected which have an operculum. This enables them to resist sudden changes of environment. *Tiara tuberculata*, a species similar to the intermediate host of *Schistosoma japonicum*, is operculated and can resist drought for several weeks.

BAKER (Frank Collins). **Fluke Infections and the Destruction of the Intermediate Host.**—*Jl. Parasit.* 1922. Mar. Vol. 8. No. 3. pp. 145–147.

In this article the author protests against the unrestricted use of sulphate of copper for the destruction of molluscs, because of its highly toxic properties for fish. The salt may be employed without harm to small bodies of water not directly connected with running streams or large lakes, but to eradicate molluscs from such streams or lakes by means of sulphate of copper would necessitate pollution to such an extent that practically all life would be destroyed.

i. MAPLESTONE (P. A.). **Notes on Australian Cestodes. III.** *Cotugnia oligorchis* **n. sp.**—*Ann. Trop. Med. & Parasit.* 1922. Mar. 31. Vol. 16. No. 1. pp. 55–60. With 6 text figs.

ii. —— & SOUTHWELL (T.). **Notes on Australian Cestodes. IV.** *Gyrocoelia australiensis* **Johnston.**—*Ibid.* pp. 61–68. With 7 text figs.

i. The author describes a parasite which has been found on four occasions in the intestine of the whistling duck (*Dendrocygna arcuata*, Cuvier) in North Queensland.

ii. The tapeworm described in this paper is a fairly common parasite. It was found in the intestines of several spur-winged plovers in North Queensland.

BAYLIS (H. A.). **Notes on some Parasitic Nematodes.**—*Ann. & Mag. Nat. Hist.* 1922. May. Vol. 9. pp. 494–504. With 8 figs.

The genera referred to in this paper are: (1) Wellcomia; (2) Ascaris, and (3) Porrocaecum.

1. A new species of Wellcomia—*Wellcomia samboni* sp. n. from the intestine of the hairy porcupine (*Coendou couiy* Desm.), Paraguay.

2. *Ascaris dasypodina* sp. n. from an armadillo (*Cabassous unicinctus*), Paraguay.

3. Two species of Porrocaecum from birds, *P. semiteres* and *P. ensicaudatum*.

BOULENGER (C. L.). **On** *Ascaris vitulorum* **Goeze.**—*Parasit.* 1922. Apr. Vol. 14. No. 1. pp. 87–92. With 3 text figs.

The author has examined specimens of this parasite taken from the Indian buffalo and from Rhodesian cattle, and finds that they are identical. They appear, however, to differ in certain points from the Ascaris of European cattle, supposing the description of that parasite to be accurate.

He has not as yet had the opportunity of examining Ascarides of European origin.

ACKERT (J. E.) & PAYNE (F. K.). **A New Parasite of the Pig.**—*Jl. Amer. Vet. Med. Assoc.* 1922. May. Vol. 61. No. 2. pp. 186–188.

The parasite described in this note was found by the authors in native pigs in Trinidad while investigating the relationship of that animal to human hookworm disease.

The new species closely resembles *Necator americanus* in proportions and general appearance, but is smaller. Constant morphological differences between the two species also occur in the angles of the ventral plates, shapes of the lateral lancets, and lengths of the terminal branches of the dorsal bursal ray.

Characters of the genus *Necator* Stiles, 1903, are given, and the parasite found in the pig, which has been named *Necator suillus* Ackert & Payne, 1922, is described in some detail. The parasite would appear to be of economic importance, as both old and young pigs were found infested, and in some cases several hundred were present. Emaciation was very marked.

LAKE (G. C.). **Carbon Tetrachloride. A Drug proposed for the Removal of Hookworms, with Special Reference to its Toxicity for Monkeys when given by Stomach Tube in Repeated Doses.**—*Public Health Repts.* 1922. May 12. Vol. 37. No. 19. pp. 1123–1126.

The author's summary and conclusions are as follows :—

" 1. Four monkeys received carbon tetrachloride by stomach tube in amounts of 1, 2, 3 and 5 cc. respectively at intervals of 2 to 3 days, over a period of from 30 to 41 days, the total number of doses varying from 12 to 16.

" 2. No symptoms of importance were shown by the monkeys during this period.

" 3. The two monkeys receiving the larger doses were subsequently used for the testing of suspected poliomyelitis virus and died of brain abscess. In each case gross and microscopic examination of the important organs failed to show any changes indicative of an exogenous poisoning.

" 4. The doses received by the monkeys at each treatment were from 10 to 40 times greater in cubic centimetres per kilogram of body weight than the dose mentioned by HALL as that indicated for man, and these doses were repeated from 12 to 16 times.

" From the data at hand, we must conclude that carbon tetrachloride by stomach has a very low toxicity for monkeys, and it is probable that man may be given considerably higher doses than the ones suggested by HALL, and that it might be safe to repeat the dosage several times at proper intervals (one week).

" Finally, in view of the unusually promising results that carbon tetrachloride has given as an anthelmintic for hookworms in animals, and in view of its unusually low toxicity for animals, including monkeys, when given by stomach, both in single and in repeated doses, we believe that it deserves an extensive trial in the treatment of hookworm disease in man.

" NOTE.—HALL has just informed the writer that he and Dr. SHILLINGER have given dogs as high as 300 cc. as a single dose without causing evident toxic symptoms."

ALLEN (J. A.). **The Efficiency of Carbon Tetrachloride against Hookworms in the Silver Black Fox.**—*Jl. Amer. Vet. Med. Assoc.* 1922. Apr. Vol. 61. No. 1. pp. 31–37.

Of 1,422 specimens—carcases and faeces—examined, 345 have been found to contain hookworms. On some ranches the percentage of infected animals reached 65.

Carbon tetrachloride has been tried for the expulsion of this parasite. The drug was given in gelatin capsules, and was followed by a small dose of castor oil. The animals were fasted for 12 to 14 hours prior to treatment. Three sets of experiments were carried out. In the first the dose recommended by HALL, 0·3 cc. per kilo, was used. In the second series double this dose was given. In the third the drug was given in a drench instead of in gelatin capsules, and no purgative was given before or after.

In the first series 23 foxes were used, and the results were checked by post-mortem examination. The combined results showed a 93 per cent. efficiency.

In the second series only four animals were used, and of these two failed to pass any parasites during life and were found free on post-mortem. Of the remaining two, one passed four worms and was found free on post-mortem, the other passed 123 worms and was found to have retained eight when killed a month later.

0·6 cc. was found to be a perfectly safe dose if given in capsules.

Two animals only were used in the third experiment. Both received the carbon tetrachloride as a drench ; one at the rate of 0·3 cc. and the other 0·6 cc. per kilo.

In both cases temporary symptoms of intoxication were produced. The animal which received the smaller dose passed one hookworm and none was found at the post-mortem.

The other passed one ascarid and no worms were found at the post-mortem examination. Carbon tetrachloride was found to be far superior to chloroform and thymol.

REES-MOGG (G.). **The Treatment of Sclerostoma with Atoxyl.**—*Vet. Jl.* 1922. Mar. Vol. 76. No. 3. pp. 103–104.

Definite diagnosis of parasitic disease was made by examination of the faeces after two drenches, each composed of 2 oz. of turpentine, ½ pint of linseed oil and 1 pint of milk.

For three days a daily drench of thymol 1 oz., oil of chenopodium 1 oz., liquid paraffin 4 oz., milk and water 3 pints, was given.

Daily injections of 10 gr. of atoxyl and powders composed of 30 gr. of arsenic were also administered.

The drenches appeared to put the pony off her appetite, the quantity of thymol was therefore reduced to ½ oz., and only two were given per week. An increase to 60 gr. of atoxyl caused purgation, but the dose of arsenic was increased to that amount.

After three weeks the drenches were discontinued [it is not clear what interval elapsed between successive sets of three daily doses of the mixture containing thymol and oil of chenopodium] but the atoxyl and arsenic were continued for a month.

Bru (P.). **Le Chénopode anthelminthique.** [Chenopodium anthelminthicum.]—*Rev. Vét.* 1922. Apr. Vol. 74. No. 4. pp. 217–225.

The common name in France is Ansérine vermifuge.

Originally a plant of tropical America, *Chenopodium anthelminticum* is now found practically everywhere. It is especially cultivated in Maryland in the United States.

The particular variety used for the preparation of the essential oil is *Chenopodium ambrosioides* var. *anthelminticum.*

The seeds of the plant contain 0·6 to 1, and the leaves 0·35, per cent. of the essence. On an average the oil contains 65 per cent. of ascaridol, 22 per cent. of cymol, and some dioxyterpene.

It is soluble in alcohol, but is not miscible with other liquids.

The drug is particularly active against round worms. It should be given after a period of fasting of at least 24 hours and should be followed by a dose of linseed or castor oil.

In its action chenopodium does not differ from other vermifuges. It does not kill the parasites, but narcotizes them, hence the necessity for the administration of the purgative immediately after.

Should one treatment fail, which may happen if the purging is not sufficiently thorough, an interval of eight days must be left before the chenopodium is repeated.

The administration of the purgative immediately after the chenopodium not only ensures the expulsion of the paralysed worms but prevents gastric absorption, hastens the passage of the drug through the intestine and thus prevents absorption of it.

Cats appear to be more susceptible to its poisonous action than dogs.

In all animals and man large doses produce deafness, which, if the dose be sufficiently large, may be permanent. When excessive doses are given death results from paralysis of the respiratory centre.

For horses the dose varies from 15 to 20 cc.

In all cases it is preferable to divide the dose into three or more parts, which are given at intervals of an hour or more. In this way the parasites are subjected to the action of the drug for a more prolonged period.

In the dog the dose is 0·1 cc. per kilo.

It is best given in gelatin capsules on account of its objectionable taste and smell, and of the burning sensation it produces. In the absence of capsules it may be given shaken up in castor oil, but it soon rises to the top and makes the administration more difficult.

The alcoholic extract is miscible with glycerine and can be made into a syrup. Powdered seeds are more convenient for horses.

The dose is from 20 to 30 gm. in the form of an electuary repeated on two or three consecutive days and followed by a purging ball.

HALL (M. C.). **The Relative Value of Treatment and Prophylaxis in the Control of Parasitic Diseases.**—*Jl. Amer. Vet. Med. Assoc.* 1922. Feb. Vol. 60. No. 5. pp. 583–599.

In this paper the author sketches outlines of the main factors involved in treatment and prophylaxis, and indicates the relative importance of each in certain cases. Broadly speaking, in the present state of knowledge treatment is more valuable than prophylaxis, but there are important exceptions. In some cases neither treatment nor prophylaxis are practicable.

SURCOUF (J.). **Note sur les Diptères piqueurs (Tabanidae) recueillis au Laos par M. Vitalis de Salvaza.** [Note on Biting Flies collected at Laos.]—*Bull. Soc. Ent. France.* 1921. Dec. 14. No. 19. pp. 285–287. [Reviewed in *Rev. App. Entomol.* 1922. Apr. Vol. 10. Ser. B. No. 4. p. 82.]

" The following new species are recorded from French Indo-China: *Tabanus euphanes, T. hypomacros, T. salvazai, T. oknos* and *T. ictericus.*"

CARPENTER (G. H.), PHIBBS (G.) & SLATTERY (T., the late). **The Warble Flies.**—*Jl. Dept. Agric. & Tech. Instruc. Ireland.* 1922. May. Vol. 22. No. 1. pp. 14–25.

The observations regarding the life-history of the fly which were published in 1914 have been confirmed; it having been definitely established that the newly hatched maggots gain access to the host's body by penetration of the skin and not *via* the mouth.

It was again found that muzzling actually increased the average number of warbles found in the experimental calves. By licking itself an animal dislodges a number of the eggs.

Feeding calves with large numbers of maggots (100) failed to infect.

In experiments in which maggots hatched out artificially were placed on the skin, and eggs themselves were placed on the skin and kept in place by bandages, negative results were obtained.

On the other hand, calves which were protected by clothing, leaving only the hind legs exposed to the attacks of flies, showed maggots the following spring. The experiment further proved the migration of the maggots from the hocks, or below, to the backs. It was not found possible to trace the migrations of the young maggots from the skin to the oesophagus, where they are found in their " second stage " from October till February.

The larva appears to pass through five phases of development. The pupal stage ranged from 46 to 32 days, decreasing as the season advanced.

During 1915, washes composed of pure nicotine and linseed oil in proportions ranging from 1 to 0·25 per cent. were tried. The 1 per cent. was found to be very effective, but it produced alarming symptoms in some of the animals and its use was discontinued. In 1919, experiments with washes containing tobacco powder and lime gave promising results.

In 1921, departmental experiments were carried out with a wash containing 4 lb. of tobacco powder, 2 lb. of lime to 1 gal. of water In the majority of cases one dressing was given, with the result that

78 per cent. of the maggots were killed. In those cases (37 in number) in which two dressings were given, 89 per cent. of the maggots perished.

A more successful treatment still was the use of sulphur dioxide gas applied under pressure (with impermeable covers over the animals' backs) for a minute. By this means, which had previously been employed and had resulted in the destruction of 93 per cent. of maggots, 96 per cent. were killed. The method, however, is not applicable on a large scale.

As yet no dressing has been found which is effective for the prevention of oviposition, but experiments are being continued.

HADWEN (S.). **Effects following Improper Methods of Extracting Hypoderma Larvae from the Backs of Cattle.**—*Jl. Amer. Vet. Med. Assoc.* 1922. Mar. Vol. 60. No. 6. pp. 724–728.

The disease described by BRODERSEN, in Denmark, as Rosenfeber, appears to be identical with hypoderma anaphylaxis. The symptoms recorded by the author are:—Fever, full pulse, distended jugulars, tremors, restlessness, oedema of dependent parts, lachrymation, and frothing at the mouth, slight tympanites and thin faeces. The breathing may be laboured. The course is acute but usually benign.

In previous papers by Hadwen, and Hadwen and BRUCE, additional symptoms were described: coughing, bleeding from the mouth and anus, irritation of the skin, and a cyanosed appearance of the body. Death may result from asphyxia. It is of the utmost importance that, if extraction of the larvae is undertaken, they should not be damaged in the process. Should a larva be broken the cavity should be flushed out quickly with water.

HILL (Laurence). **Three New Species of** ***Trichodectes*** **from** ***Cephalophus monticola*** **and** ***Procavia capensis*** **from South Africa.**—*Parasitology.* 1922. Apr. Vol. 14. No. 1. pp. 63–69. With 1 plate.

This paper contains a detailed description of three new species of lice, *Trichodectes bedfordi, Trichodectes lindfieldi,* and *Trichodectes serraticus.* The first of these were obtained from the blue duiker in Natal, and the last two from a Cape hyrax in the same Province.

MILLER (D.). **The Cattle Tick and other Ticks in New Zealand.**—*N.Z. Jl. Agric.* 1922. Jan. Vol. 24. No. 1. pp. 1–7. With 5 figs. and 1 map. [Reviewed in *Rev. App. Entomol.* 1922. May. Vol. 10. Series B. No. 5. p. 114.]

No tick-borne diseases occur among domestic animals in New Zealand. The species present in the Dominion are: *Haemaphysalis bispinosa, H. leachi, Hyalomma aegyptium, Ixodes ricinus, I. eudyptidis, I. apteridis, I. aptericola, I. anatis, I. intermedius.*

The first of these is the only one having a wide distribution. It chiefly infests cattle, but is common on rabbits and hares, and frequently attacks sheep, dogs and fowls. In some cases, horses are heavily infested and occasionally man.

Allen (J. A.) & Wickware (A. B.). **A Preliminary Note on Parasites infesting Domesticated Silver Black Foxes in Canada.**—*Parasitology.* 1922. Apr. Vol. 14. No. 1. pp. 27–28.

Protozoa.

Coccidium bigeminum—*Isospora bigemina* (Stiles, 1893).	Small and large intestine.

Acarina.

Sarcoptes scabiei vulpis (Fürstenberg, 1861) Railliet.	Body.
Otodectes cynotis (Herring, 1838)	External meatus, ears.

Siphonaptera

Ctenocephalus canis (Curtis, 1826) ..	Body.

Nematoda.

Eucoleus aerophilum (Creplin, 1839) ..	Trachea and bronchi. Eggs found in trachea, oesophagus and faeces.
Belascaris cati (Schrank, 1788)	Small intestine.
Belascaris marginata (Rudolphi, 1802) ..	
Toxascaris limbata (Railliet & Henry, 1911)	
Nucinaria polaris (Looss, 1911)	

Trematoda.

Ascocotyle longa (Ransom, 1920)	Small intestine.
Echinochasmus sp.	

Erratum.

Vol. 10, page 39, third para. The bracketed insertion should have been deleted in proof. The genus *Bustomum* was created by Clayton Lane (1917), *Indian Jl. Med. Res.* Vol. 4, p. 419.

Austen (E. E.). **Some Siamese Tabanidae.**—*Bull. Ent. Res.* 1922. Feb. Vol. 12. No. 4. pp. 431–455. With 7 figs.

Baylis (H. A.). **Observations on Certain Cestodes of Rats, with an Account of a New Species of** *Hymenolepis.*—*Parasitology.* 1922. Apr. Vol. 14. No. 1. pp. 1–8. With 4 text figs.

Beard (J.). **The Fowl Tick.**—*Queensland Agric. Jl.* 1922. Jan. Vol. 17. No. 1. pp. 25–26. With 1 fig.

Chandler (A. S. A. C.) & Suttles (Charles L.). **A New Rat Tapeworm,** *Schizotaenia sigmodontis,* **from North America.**—*Jl. Parasitol.* 1922. Mar. Vol. 8. No. 3. pp. 123–128. With 1 plate.

Crawley (H.). *Davainea proglottina,* **a Pathogenic Cestode in American Poultry.**—*Jl. Amer. Vet. Med. Assoc.* 1922. June. Vol. 61. No. 3. pp. 305–310. With 1 text fig.

Cunliffe (Norman). **Some Observations on the Biology and Structure of** *Ornithodorus savignyi,* **Andouin.**—*Parasitology.* 1922. Apr. Vol. 14. No. 1. pp. 17–26. With 3 text figs.

Dollfus (R. P.). **Sur la présence en France et en Corse du** *Bullinus contortus* **(Michaud), hôte intermédiaire de** *Schistosoma haematobium* **(Bilharz). Note préliminaire.** [Preliminary Note on the Occurrence in France and Corsica of *Bullinus contortus* (Michaud), the Intermediate Host of *Schistosoma haematobium* (Bilharz).]—*Bull. Soc. Path. Exot.* 1922. Apr. Vol. 15. No. 4. pp. 208–212.

Ferris (G. F.). **The Mallophagan Family,** *Trimenoponidae.*—*Parasitology.* 1922. Apr. Vol. 14. No. 1. pp. 75–86. With 8 text figs.

Hopwood (A. T.). **An Interesting Case of** *Cysticercus fasciolaris* **infesting the Brown Rat.**—*Parasitology.* 1922. Apr. Vol. 14. No. 1. p. 14. With 1 plate.

Le Bas (G. Z. L.). **Of the Nature of the Antigen in the Complement-Fixation Test for Bilharzioses.**—*Jl. Trop. Med. & Hyg.* 1922. Mar. 1. Vol. 25. No. 5. pp. 49–55.

Newstead (R.). **A New Species of Phlebotomus from Trinidad.**—*Ann. Trop. Med. & Parasit.* 1922. Mar. 31. Vol. 16. No. 1. pp. 47–50. With 1 text fig.

NEWSTEAD (R.) & EVANS (A. N.). **A New Tsetse-fly from the South Cameroons.** —*Ann. Trop. Med. & Parasit.* 1922. Mar. 31. Vol. 16. No. 1. pp. 51–54. With 2 text figs.

ORTLEPP (R. J.). **On the Hatching and Migration in a Mammalian Host of Larvae of Ascarids normally Parasitic in Cold-blooded Vertebrates.**—*Jl. Trop. Med. & Hyg.* 1922. Apr. 15. Vol. 25. No. 8. pp. 97–100.

RILEY (William A.) & SHANNON (W. R.). **The Rat Tapeworm,** *Hymenolepis diminuta*, **in Man.**—*Jl. Parasit.* 1922. Mar. Vol. 8. No. 3. pp. 109–117.

ROGER (J.). **La dyspepsie parasitaire et le complexus symptomatique lié au parasitisme gastro-intestinal. Diagnostic et traitement.** [Parasitic Dyspepsia and the Symptom-Complex due to Gastro-intestinal Parasitism. Diagnosis and Treatment.]—*Rev. Vét.* 1922. Feb. & Mar. Vol. 74. Nos. 2 & 3. pp. 73–85 & 153–165.

SURCOUF (J.). **Diptères piqueurs du Laos. (Tabanidae), 2e Note.** [Tabanidae at Laos.]—*Bull. Soc. Ent. France.* 1922. Jan. 11. No. 1. pp. 13–15.

WATERSTON (James). **A Contribution to the Knowledge of the Bionomics of Sand-Flies.**—*Ann. Trop. Med. & Parasit.* 1922. Mar. 31. Vol. 16. No. 1. pp. 69–92. With 7 text figs. and 1 plate.

WHARTON (L. D.). *Opisthorchis wardi*, **a New Species of Liver Fluke from the Cat in the Philippine Islands.**—*Philippine Jl. of Science.* 1921. Aug. Vol. 19. No. 2. pp. 243–244. With 1 plate.

BACTERIAL DISEASES.

ZAMMIT (T.). **Undulant Fever in the Goat in Malta.**—*Ann. Trop. Med. & Parasit.* 1922. Mar. 31. Vol. 16. No. 1. pp. 1–10. With 2 plates.

Whereas the putting into force of an order requiring the boiling of all goat's milk for the naval and military forces in Malta produced an immediate disappearance of the disease from among them, there has not been any decrease of the disease among the Maltese population, because that precaution is not taken. It is, however, against the law for unboiled milk to be sold in hotels, restaurants, etc.

The goats number some 20,000, and these are subjected to periodic inspection, when samples of milk or blood are taken. Reacting goats are assessed and slaughtered. The staff available is not sufficient to allow for the examination of all the goats annually. From the figures given it appears that the number of goats examined annually since 1907 has ranged from 1,000 to 13,000, and that the average for the last few years has been between 5,000 and 6,000. The percentage of infected goats discovered in 1907 was 14, and for the last seven years it has been about 5.

This, however, is a dangerous percentage, as a single goat may infect a large number of people during a period of lactation.

Attempts to prepare a vaccine have as yet not yielded practical results of any value.

The author challenges a statement made by VINCENT (1918) to the effect that an infected goat recovers spontaneously, and states that he has never known an infected goat to recover. He states, nevertheless, that "the blood may completely lose its agglutinating power, but a careful post-mortem examination shows, as a rule, the micrococcus lurking in one or another of the glands."

It is also stated that a goat which has appeared to be perfectly healthy and free from an infection contracted two years previously yields milk teeming with *M. melitensis.*

KHALED (Z.). **A Comparative Study of Bovine Abortion and Undulant Fever, from the Bacteriological Point of View.**—*Jl. of Hygiene.* 1921. Dec. Vol. 20. No. 4. pp. 319–329.

In the investigations detailed in this paper 13 strains of *B. melitensis*, 10 of *B. abortus*, and 3 of *B. paramelitensis* have been examined. They are said to be representative of strains isolated in America, on the Continent, and in this country.

The author supports the view put forward by MEYER and FEUSIER that a special genus—" Brucella "—should be made for these three organisms.

A brief account of the morphology and cultural characters of the organisms is given.

In a section devoted to methods of infection the author states, in connexion with *B. abortus*, that after abortion takes place " The animal recovers and then either remains sterile or aborts soon after service, generally after two months. . . . . The males apparently act as carriers. The causal organism can be isolated from the spleen, liver, testes, seminal vesicles and uterine discharges, as well as from the milk; the foetal membranes, stomach, amniotic fluid and cotyledons as a rule give pure cultures. Isolation and disinfection are very effective measures."

Although 26 strains of the three organisms are mentioned in the early part of the paper, the author later states that 30 were used.

In the agglutination tests, details of the results with only 9 of these are given. Of these, 3 were *B. melitensis*, 2 *B. paramelitensis*, and 4 *B. abortus*.

Antisera, prepared from rabbits, were used against all of these. A serum was considered satisfactory only when it caused agglutination with the homologous organism in a dilution of 1 in 6,400.

Anti-*melitensis* serum agglutinated *B. melitensis* and *B. abortus* to about the same extent, and was practically inactive with *B. paramelitensis*.

Anti-*abortus* serum agglutinated all the nine strains to about the same extent, while anti-*paramelitensis* serum was active almost exclusively with its homologous organism, no agglutination taking place with any of the other strains in dilutions above 1 in 200.

In the absorption tests the results obtained with only five or six of the strains used are given, and only *B. melitensis* and *B. abortus* were used.

B. melitensis removed from anti-*melitensis* serum all agglutinins for *B. melitensis* and *B. abortus*.

B. abortus removed from anti-*melitensis* serum all agglutinins for the same organisms.

B. abortus removed from anti-*abortus* serum all agglutinins for *B. abortus* and *B. melitensis*.

B. melitensis removed from anti-*abortus* serum all agglutinins for *B. melitensis*, but not those of *B. abortus*; this organism was still agglutinated in dilutions of 1 in 800 after the absorption.

The author has carried out some experiments to test the relative pathogenicity of the organisms, " a few of which will be mentioned." Those mentioned lack, however, precision, and are of little value.

In a single experiment, inoculation of a monkey with *B. abortus* was found to confer some degree of immunity against a subsequent inoculation with *B. melitensis*; the control monkey showed a febrile reaction to the test inoculation, which lasted a month, and continued to lose weight.

In regard to the pathogenicity for man, the author states that he has seen cases in Egypt which were typical undulant fever, confirmed by laboratory diagnosis, in persons who have never ingested goat's milk. He suggests that *B. abortus* bears to *B. melitensis* a relationship similar to that of cowpox to smallpox.

SKARIĆ (J.). **Über die Beziehungen des** *Bac. melitensis* **(Bruce) zum** *Bac. abortus infect. bovum* **(Bang).** [The Relationship between *B. melitensis* and *B. abortus*, Bang.]—*Zeitschr. f. Hygiene u. Infektionskrankh.* 1922. Mar. Vol. 95. No. 3. pp. 358–364.

The author has carried out a number of tests with different strains of abortion bacilli and undulant fever organisms and with immune sera prepared by means of these. The results are parallel with those obtained by other investigators.

He suggests that agglutination shown by the serum of patients with undulant fever bacilli may possibly be due to agglutinins elaborated as a result of the ingestion of milk containing abortion bacilli.

ZIEMANN (H.). **Ueber die Behandlung des Maltafiebers und des infektiösen Abortes der Rinder mit Kollargol und ähnlichen Präparaten.** [The Treatment of Malta Fever and Contagious Abortion of Cattle with Collargol and Similar Preparations.] *Deut. Med. Wochenschr.* 1921. May 5. Vol. 47. No. 18. p. 500.

The author states, in this brief note, that he has been able to effect a cure in cases of undulant fever by intravenous injections of a two per cent. solution of Collargol. The dose was from 2 to 4 cc.

In one case a single injection sufficed, but in others a second injection was given. In the absence of further cases upon which to try the method he has turned his attention to contagious abortion because of the similarity of the causal organisms. It is not clear that he has actually carried out any experiments in this connexion. No results are given.

LITTLE (Ralph B.) & ORCUTT (Marion L.). **The Transmission of Agglutinins of** *Bacillus abortus* **from Cow to Calf in the Colostrum.**—*Jl. Experim. Med.* 1922. Feb. 1. Vol. 35. No. 2. pp. 161–171.

"The experiments to be reported differ from those of others in that they deal with the naturally acquired and stored agglutinins as the result of a definite infectious disease of cows, localized in the foetal membranes. Earlier experiments deal only with agglutinins experimentally induced."

The bulk of the paper is composed of tabular statements of the various experiments carried out, and these do not lend themselves readily to abstraction.

The authors state that, with rare exceptions, the blood of a new-born calf is free from agglutinins until it has sucked, although the blood and the colostrum of the dam may have a relatively high content of agglutinins.

When colostrum was withheld, and milk of a low or negative titre substituted, agglutinins failed to appear or accumulate in the blood of the calf.

The concentration of agglutinins in the colostrum may exceed that of the blood at or immediately after parturition.

Agglutinins begin to appear slightly over an hour after the calf has ingested colostrum, and in nearly all cases were at a maximum five hours after feeding.

The problem of the production of agglutinins by the foetus in whose tissues *B. abortus* has multiplied, and which is subsequently expelled prematurely, is not touched by these observations.

SCHROEDER (E. C.). **Bureau of Animal Industry Investigations on Bovine Infectious Abortion.**—*Jl. Amer. Vet. Med. Assoc.* 1922. Feb. Vol. 60. No. 5. pp. 542–561.

This paper, which was read before the United States Live Stock Sanitary Association, gives a summary of our knowledge regarding the various aspects of contagious abortion.

NEWSOM (I. E.) & CROSS (F.). **Investigations on the Use of Vaccines made from** *Bacillus ovisepticus.*—*Jl. Amer. Vet. Med. Assoc.* 1922. Feb. Vol. 60. No. 5. pp. 562–579.

The publication of the results obtained by Van Es and MARTIN has led to questions not only as to whether the vaccines on the market are of any value against diseases of the haemorrhagic septicaemia group, but whether there is any secure basis for the methods employed.

As various investigators have had non-concordant results with the methods involving the use of killed or virulent living organisms, the authors have carried out a small number of experiments with vaccines both dead and living.

The first experiments were carried out with rabbits. Broth cultures were used. These were found to contain 7–10 billion organisms per cubic centimetre. The minimum lethal dose of these cultures for rabbits was found to be ·000,001 cc.; an animal receiving one-tenth of this dose survived.

The dead vaccine was a broth culture of the same strength. It was killed by heating at 60° for 30 minutes, and 0·5 per cent. carbolic acid was afterwards added.

Rabbits given varying doses of vaccine and subsequently varying doses of virulent culture in doses ranging from ·001 to ·000,000,1 cc. all died. The vaccines therefore had no immunizing effect. The test doses were given in one case after an interval of 11 days and in another case 17 days. Young lambs given 2 cc. of vaccine all succumbed when given test inoculations at 11 days interval.

Two lots of vaccine prepared commercially were tested, and, in a small number of experiments carried out with lambs, one of these was apparently of some value in conferring a slight degree of immunity. No details are given of the manner of preparing these vaccines.

Vaccines which were carbolized without having been killed by heat appeared, in the four animals treated, to have some immunizing value.

An experiment in which carbolized (unheated) culture was used as the vaccine, and the test inoculation was given subcutaneously instead of intravenously, as in the previous experiments, failed to provide any definite information, as two of the three controls recovered.

The administration of increasing doses of carbolized vaccine (up to a final dose of 20 cc.) subcutaneously was found to increase the agglutinin content in one instance but not in another. The subsequent intravenous inoculation of these animals with increasing doses of culture up to a maximum dose of 15 cc. caused a further rise in the agglutinin content. In neither case was agglutination caused in a dilution higher than 1 in 250.

In a test with a small number of sheep (three in each batch) the result indicated that live vaccine produced a higher degree of immunity than carbolized vaccine.

The authors conclude that there would probably be little risk in using live vaccines for the subcutaneous inoculation of sheep, but that probably the minimum lethal dose of every strain used for the production of vaccine would have to be determined.

The authors have not had any results comparable to those of MIESSNER and SCHERN, whose culture was fatal to sheep in doses of a few loopfuls.

ZSCHOKKE. **Versuche zur Herstellung eines flüssigen Rauschbrandimpfstoffes.** [Experiments regarding the Production of a Liquid Vaccine against Black Quarter.]—*Schweiz. Arch. f. Tierheilk.* 1922. Mar. Vol. 64. No. 3. pp. 97–105.

The author describes results obtained from the immunization of animals with filtered subcutaneous exudate and peritoneal fluids.

By a process of inoculating the cattle with infective material subcutaneously in about twenty different places at the same time, it was found that an ox would furnish about eight litres of subcutaneous and peritoneal exudate. This was mixed with carbolic acid 0·5 per cent. and promptly filtered.

A large part of the article consists of a tabular statement of the experiments carried out. This does not lend itself to abstraction. The author's conclusions may be summarized as follows :—

Germ-free exudates may be used for the inoculation of animals, and even when large doses are given produce no toxic effects. The injection produces a solid immunity. The dose required to effect this is 0·5–1 cc. for a guinea-pig and 1–2 cc. for an ox. The peritoneal exudate is rather less effective than the subcutaneous fluid—about twice the dose is required for the immunization of guinea-pigs.

The immunity is an active one. It is not acquired until ten days after inoculation and lasts five months at least. The immunity is effective not only against the strain used for the production of the virus, but against other strains as well.

When kept in the cool and the dark the vaccine retains its power for four months, after which it slowly becomes less and less effective.

Six thousand doses have been used in general practice. The results will be published later.

MARZINOWSKA (A. F.). [**On the Rôle of Wild Birds in the Dissemination of Chicken Cholera.**]—Reprinted from *Medicinskoye Obozreniye* (*Med. Review*). Moscow. 1916. No. 5–6. 5 pp. With 1 plate.

The author isolated an organism which was the cause of a severe outbreak of chicken cholera amongst wild rooks and crows in Moscow in 1914. It differed slightly from the bacillus of chicken cholera in its mode of growth in cultures and in its pathogenic properties, on account of which the author proposed to name it *Bacillus avisepticus corvinus*. Cultures of this organism were successfully inoculated into pigeons, producing symptoms of chicken cholera and causing their death. In natural conditions the disease seems to be disseminated through the faeces of infected wild birds. A jackdaw placed in a cage which contained the excrements of infected birds contracted the disease in three days and died on the fourth.*

CARINI (A.). **Phenololipoid N. in Experimental Infection by *Micrococcus melitensis* (Chemotherapic Notes).**—*Jl. Trop. Med. & Hyg.* 1922. Jan. 2. Vol. 25. No. 1. pp. 1–2.

GHINEA (I.). **Contributions à l'étude du diagnostic de la morve chez le mulet par la malléine.** [The Diagnosis of Glanders in the Mule by means of Mallein.]—*Archiva Veterinara.* 1921. Vol. 15. No 3. pp. 97–118.

MARSHALL (C. J.). **Haemorrhagic Septicaemia.**—*Jl. Amer. Vet. Med. Assoc.* 1922. June. Vol. 61. No. 3. pp. 238–242.

UCHIMURA (Y.). **Experimentelle Untersuchungen zur Biologie des Rauschbrandbacillus.** [Experimental Investigations of the Biology of the Bacillus of Black Quarter.]—*Zeitschr. f. Hyg. u. Infektionskrankh.* 1921. May. Vol. 92. No. 2. pp. 291–320.

DISEASES DUE TO FILTERABLE VIRUSES.

EICHHORN (A.) & LYON (B. M.). **Prophylactic Vaccination of Dogs against Rabies.**—*Jl. Amer. Vet. Med. Assoc.* 1922. Apr. Vol. 61. No. 1. pp. 38–42.

The authors' investigations were undertaken with a view to check results claimed by UMENO and DOI in Japan.

During the war rabies spread very widely in Japan, and attempts were made to inoculate dogs against it. The claim is made that a degree of immunity sufficient to protect dogs for a year can be established by a single injection of a special preparation of fixed virus. The brain and spinal cord of a rabbit dead of fixed virus rabies is ground up and mixed with four volumes of a mixture of glycerin 60 parts, water 40 parts, and carbolic acid 1·25 parts. This mixture is stored at 18°–22° C. (*i.e.*, room temperature) for two weeks, or in an ice chamber for three weeks, to reduce its virulence.

At first the vaccine was used diluted, but subsequently at the strength given.

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* Summarized by Mr. Cecil A. Hoare, B.Sc.

It is said that this vaccine retains its properties for two to three months at room temperature.

A number of experiments were made with a view to determine the dose, and it was finally established that one injection of 5 cc. per 15 kilos weight of the one-fifth dilution should be used.

Up to 1921 31,307 dogs were vaccinated in two Prefectures in Japan. Only one animal died from accidental causes following vaccination, and in one instance the vaccine failed to protect against natural exposure to infection. As a result of the vaccinations the cases were reduced by 75 per cent., and the disease occurred only among unprotected dogs.

To test the value of the method the authors of the present paper injected six dogs subcutaneously with 5 cc. of vaccine, and 25 days later these, along with three unvaccinated controls, were inoculated intraocularly with 0·05 to 0·1 cc. of a suspension of brain material from three dogs known to have died from rabies; the suspension was made up of 10 per cent. strength in salt solution.

The six protected dogs lived and the three controls died in 15 to 17 days.

Six rabbits were inoculated—two from each—from the control dogs. Four died of rabies, one from shock and one survived. The deaths were distributed among the three batches.

✓Pool (W. A.) & Doyle (T. M.). **The Preparation of Anti-Rinderpest Serum, using Animals of Moderate Susceptibility as Virus Producers. Part I. Buffaloes.**—43 pp. 1922. Bulletin No. 129. Agricultural Research Institute, Pusa. Calcutta: Supt. Govt. Printing.

The work described in this Bulletin was undertaken with a view to decide whether it is absolutely essential that animals possessing a high degree of susceptibility to rinderpest should be used as virus producers.

In the absence of any experimental evidence to the contrary it has been held that for the production of a potent serum the animals furnishing the virus for hyperimmunization should be as susceptible as possible.

The authors show that the problem of obtaining highly susceptible cattle for this purpose at Muktesar is, after having been increasingly difficult of solution for a number of years, now becoming insoluble.

With an ever increasing demand for serum and an ever diminishing supply of susceptible cattle for virus production steps had to be taken to find some substitute. Attention is also called to the possible results of an extensive outbreak of rinderpest in the areas of the Kumaun Hills, from which the highly susceptible virus producers have been drawn.

For many years the question of establishing further laboratories for serum production in India has been under discussion, and at different times actual selections of sites have been made, only to be abandoned on the score that susceptible animals were not available in sufficient numbers within reach of the proposed site.

Young male buffaloes, regarding which the Indian has no religious prejudices, as he has in the case of bovines, have been used in emergency as virus producers in the past, but only when inoculated direct from hill bulls.

It was therefore necessary to ascertain whether virus maintained by passage from buffalo to buffalo retained a sufficient degree of virulence to be serviceable for hyperimmunizing purposes, and whether buffaloes hyperimmunized with such virus would produce an efficient serum.

A series of experiments has therefore been carried out in which young buffaloes were solely used for the production of virus and large buffaloes for the production of serum.

In all, eleven brews of serum, each comprising 10,000 doses (5 cc.), have been prepared upon this plan, and the potency of eight of the brews has been tested on hill bulls in the usual way.

The conclusions arrived at are :—

1. A potent anti-rinderpest serum can be prepared from virus producers which have only a moderate susceptibility to the disease.
2. The continued use of buffalo antigen did not produce any deterioration in the potency of the serum prepared up to one lakh and 10,000 doses involving 34 subpassages.

Piot-Bey (M.). **A propos des vaccinations antipestiques par le procédé Gordziakowski.** [The Gordziakowski Method of Immunizing against Rinderpest.]—*Rec. Méd. Vét.* 1922. Apr. 15. Vol. 98. No. 7. pp. 194–197.

The author draws attention to the fact that in 1883 he attempted to immunize animals against rinderpest by a single injection of virus heated to 54°. The virus was subjected to this temperature for twelve minutes. The temperature and the duration of the heating were arrived at by experiment.

During the year mentioned 1,004 head of cattle were inoculated with this heated virus. The results were at first excellent, then doubtful, and finally the author was lead to conclude that the results were not sufficiently constant to warrant the application of the method without modification.

Attention is drawn to these points only for the purpose of showing that heated virus is entirely innocuous.

The light shed upon the nature of the disease shows how idle it is to try to prepare a vaccine, and the author thinks, therefore, that Gordziakowski has been following a wrong track in his attempts to prepare a vaccine by heating the virus.

Xémard, who has found the method useless in a small number of experiments in West Africa, failed to get any evidence of systemic reaction following the inoculations. Gordziakowski claims to have produced a rise of temperature in practically all the animals treated, and clinical symptoms followed by death in from six to eight days in three of the animals treated.

These results were obtained on infected premises where the disease was certainly incubating. This explains the three deaths. One is forced to the conclusion that either the blood was heated sufficiently to destroy its virulence, or that it was insufficiently heated and conveyed the infection.

The results obtained in Poland should have lead the operator to conclude that his first vaccine had been without effect. The immunity shown to have been established by the second inoculation with virulent blood twelve days later was natural and certainly not due to the vaccine.

The author suggests that where simultaneous inoculation is impracticable on the score of shortage of staff or funds, isolation should be tried as offering the next best chance of controlling the disease.

HENRY (M.). **Some Untoward Results following Inoculation against Pleuropneumonia Contagiosa in Bovines.**— *Vet. Jl.* 1922. Apr. Vol. 78. No. 4. pp. 139–145.

During 1921 a somewhat extensive outbreak of pleuropneumonia occurred in a dairying district in New South Wales which had been comparatively free for some time. The infection was apparently brought in by a particular mob of cattle which were sold and distributed over the district. The outbreak was dealt with in the usual way; viz., infected premises were quarantined, affected animals destroyed, and incontacts inoculated.

" Natural virus " was used for the purpose, and this was obtained in the following way. An affected animal was selected and killed by shooting or stunning and bled. Care was taken not to damage the trachea. With the animal lying with its head downhill the abdominal organs were removed. A slit was then made in the diaphragm and with a sterilized enamelled cup the exudate was baled out and poured into a sterile bottle. This was used for the inoculation of incontacts, in most cases without preservative, but in one case 30 per cent. glycerin was added. The virus was used to impregnate strands of worsted about an inch long, and these were inserted into the tail about an inch from the tip. Although the protection afforded could not in any instance be said to have broken down, the results were very variable. These are given in detail for 15 farms, and are also tabulated.

Virus.	Taken.	Used.	Herds Inoculated.	Inoculated by.	Result.
No. 1	24/8/21	25/8/21	Farm B. (19)	B.	A. 3.
		25/8/21	Farm D. (26)	B.	—
		25/8/21	Farm E. (26)	B.	D. 8.
		30/8/21	Farm F. (31)	B.	A. 3.
		20/8/21	Farm G. (24)	B.	A.14. D. 3.
		5/9/21	Farm K. (50)	A.	—
No. 2	29/7/21	6/9/21	Farm C. (24)	C.	D. 3. A. 4.
		27/8/21	Farm H. (24)	A.	D. 1. A.11.
		29/8/21	Farm I. (40)	A.	A. 6.
		29/8/21	Farm J. (35)	A.	D. 4. A. 9.
		29/8/21	Farm L. (26)	A.	A. 2.
		6/9/21	Farm N. (18)	A.	D. 1. A. 3.
			Farm O. (60)	B. 20 A. 40	D. 1. A. 2.
No. 3	12/8/21	22/8/21	Farm M. (25)	B.	—

D.=Deaths. A.=Amputations. Numbers in parentheses indicate numbers in herds. A. B. and C.=persons carrying out inoculations.

It will be seen that Operator B. used virus No. 1 on three farms on the same day, and that on one premises eight died, on another three tails were amputated, and on the third there were no ill effects. The standard of management on these three farms was good, average, and poor respectively. Contaminations in the virus would not appear to be the explanation, because when the virus was used ten days later by A. on another farm there were no bad results. The method of inoculation used could hardly be the explanation, as the results following inoculations with virus No. 2 injected by A. were even more serious.

There was no evidence that pyogenic bacteria were responsible, nor were injuries to the caudal bones the cause.

Many cases were examined, ante- and post-mortem, and in all cases the lesions presented similar appearances. The skin, except where it had become necrotic, was normal. The connective tissues, superficial and deep, were markedly oedematous. The latter presented an appearance recalling that shown by the lungs in a typical case, in that there were strands of fibrous tissue surrounding cavities containing exudate—these taking the place of the lung tissue in a typical lung lesion. The muscular tissue was normal.

Although the reactions were severe these were in some cases very delayed. In the majority of cases the period of incubation was three weeks, but in some it was delayed to six or seven weeks.

Among the factors contributing to the results was the fact that the majority of the animals inoculated were dairy cows in milk; this meant two journeys a day from the paddocks, and, where management was not very good, a certain amount of rough handling and tail twisting.

MONTGOMERY (R. Eustace). **On a Form of Swine Fever Occurring in British East Africa (Kenya Colony).**—*Jl. Comp. Path. & Therap.* 1921. Sept. & Dec. Vol. 34. Nos. 3 & 4. pp. 159–191; 243–262. With 4 charts.

The work reported in this paper was spread over the years 1900 to 1917, and publication was delayed by the author's transfer to other parts of Africa. It is acknowledged that the work is incomplete, but as there appears to be no immediate prospect of continuation of the research, he has thought it advisable to publish an account of his investigations.

A paper of this length, packed as it is with experimental data, does not lend itself readily to abstraction, but the main results may be gathered from the author's summary as follows:—

Swine fever was first diagnosed in East Africa in 1910. Between that date and 1915, 15 naturally occurring outbreaks were recorded. The total number of pigs involved was 1,366, and of these 98·9 per cent. died.

The disease is very rapidly fatal, death taking place within 48 hours. The symptoms are those of an acute febrile disease. Diarrhoea is rarely observed. Cyanosis of the skin is an obvious symptom in white pigs. Paresis and inco-ordination of the hindquarters are marked.

The lesions found are those of a septicaemia: Haemorrhagic gastritis, enlargement of the spleen, petechiae in the kidneys and on the cardiac walls, oedema of the lungs, general enlargement of the lymphatic glands. The presence of diphtheritic deposits in the intestines is extremely rare.

After inoculation the period of incubation is about three and a half days and the average duration of reaction is four days.

Only domestic pigs (the progeny of imported stock) show symptoms of the disease. The wild pig harbours the virus in the blood after inoculation, but shows no external evidence of infection.

Blood, serum, thoracic and peritoneal fluids, urine, faeces and bile have been proved to be capable of causing infection.

Simple contact is a very sure way of transmitting the infection. Experimental feeding with infective material is uncertain.

The virus is ultravisible and passes through Berkefeld and Chamberland F. filters. The virus may be preserved for at least 18 months; decomposition and desiccation act destructively upon it.

It is less stable when heated than the European virus. It resists 50° C. for three and a half hours, but 60° C. proves fatal after ten minutes exposure. Heating at 55° C. for half an hour generally causes a reduction in virulence. An exposure to 50° C. for four hours produces a similar effect. In these less acute cases diphtheritic deposits may be found in the intestines.

Pigs in contact with infected pigs which are not showing any objective symptoms may fail to contract the disease if the infected pigs be removed before symptoms become developed.

Styes readily lose their infectivity. The styes are almost certainly free from danger if left unoccupied for ten days.

The ingestion of a pig dead of the disease by others may set up the disease in them. Immediate contact between healthy and diseased is necessary for the transmission of the infection.

The source of the virus remains a matter of doubt. The outbreaks which occurred among the domestic pigs could not be connected with each other in any way. There would appear, therefore, to be some reservoir. Experiments with bush-pig and wart-hogs are too scanty to permit of any sound conclusions being drawn, but it was proved that the virus persisted in the blood of an inoculated bush-pig up to 17 days.

The view is put forward that in nature the virus is maintained through the carnivorous habits of swine, and not by ordinary contact. Recovery does not establish absolute immunity, but a certain degree of resistance only (save in one case).

Anti-swine fever serum prepared in England and in Hungary appeared to be quite ineffective.

The serum of the pig which had aquired complete immunity was valueless for protective purposes. Pigs immune to English swine fever contracted a fatal infection with the East African strain.

Virus heated to a point which produced attenuation appeared to confer some immunity.

Subacute pulmonary and intestinal changes which were sometimes observed are considered to be due to some cause other than the virus.

SPREULL (J.). **Heartwater.**—*Jl. Dept. Agric. (S. Africa).* 1922. Mar. Vol. 4. No. 3. pp. 236–245.

The main object of this paper, published as it is in an agricultural journal, is to impress upon farmers the extreme importance of dipping, but it is valuable apart from this in that it summarizes our existing knowledge of the disease.

Heartwater is defined as a specific febrile disease affecting sheep, goats and cattle in South Africa, due to an ultravisible virus transmitted by the bont tick *Amblyomma hebraeum.* It derives its name from the most prominent lesion, namely, effusion of plasma into the pericardium and chest cavity.

The disease is transmissible by inoculation with blood, spleen pulp, effusions, and milk from a freshly dead animal.

The blood remains infective for a short time only after the temperature has become normal, but animals may become affected a second time. It has been shown that a single tick is sufficient to transmit the disease.

Prior to the introduction of dipping, heartwater rendered sheep and goat farming impossible in the lower lying areas, and it is still a scourge in low veldt districts in the Transvaal.

While small stock generally are susceptible to infection, the susceptibility varies with different breeds. The Angora goat is the greatest victim, then the Boer goat, Merino sheep and its crosses, and the Afrikander. Persian sheep generally escape with a febrile attack only. Cattle are less susceptible than sheep. The springbok is known to be affected occasionally. Horses are insusceptible.

Transmission naturally is by the tick. The infection does not pass through the egg, but a tick picking up the infection in one stage transmits it in the next. If the next stage is passed on an insusceptible animal the tick does not thereby lose its infectivity.

Amblyomma hebraeum is the principal infecting tick, but *A. variegatum* is also capable of transmitting the disease.

The life-cycle of *A. hebraeum* is as follows: Egg-laying begins in 2–12 weeks after engorgement, and lasts for 3–9 weeks. Hatching takes place in 4–6 months on an average, but the period may be shorter or longer, depending upon the temperature.

Time of engorgement of the larva 5–7 days. Moulting of the larva takes 1–3 months. Engorgement and moulting of the nymph require 4–8 days and 4–12 weeks respectively. In the final stage the female seeks the male after he has fed for several days, and copulation takes place while both are attached. The female remains attached for 10–20 days, while the male may remain for several weeks and probably mates again.

The complete life-cycle therefore occupies a period of not less than 9 months, and may amount to two years. Further larvae, nymphs, and adults may live 7, 6, and 12 months respectively without having access to a host.

The tick requires a certain degree of warmth and moisture for its maintenance, and although it is annually brought on to the high veldt it has not become established there. LOUNSBURY has shown that moulting at very low temperatures deprives them of their infectivity, but that warming them in an incubator prior to placing them on a host restores that virulence.

The lesions of the disease are sometimes inconspicuous. The presence of serous fluid in the chest and pericardium is characteristic but not invariable. The fluid is in the nature of a transudate; there is no true pleurisy or pericarditis. The liquid clots quickly when it is withdrawn.

There may be some peritoneal effusion, and the fourth stomach may show inflammatory changes in the mucous membrane, including tiny blood markings. The spleen is enlarged and softened. The brain and membranes are congested, and the spinal fluid in excess.

In cases of natural infection the period of incubation is 11–18 days. By intravenous blood inoculation the period of incubation may be reduced to 10 and 5 days, depending upon the dose given. By subcutaneous inoculation the period may be from a fortnight to three weeks.

The symptoms are most obvious in the goat, and usually the first to be observed is stiffness. If such a goat be urged to move, evidence of respiratory distress will make its appearance. Depression and cessation of rumination are observed soon after. Evidence of nervous disturbance is seen in some cases from the onset, squinting eyes, bleating, salivation and chewing movements, etc. A single fit or a succession of them may be seen in some cases.

In some cases death occurs without any premonitory symptoms being observed.

In a period of some weeks after recovery from a severe attack both sheep and goats will cast their fleece.

The fever reaction is peculiar. It usually rises abruptly to 105 or 106°, remains there for a day or two and drops just as suddenly. It may be subnormal shortly before death.

In cattle the symptoms are not so pronounced, and it appears to be highly probable that animals reared on infected veldt acquire immunity. In small calves the symptoms resemble those seen in the goat, but are not quite so marked.

Death usually occurs on the fourth day. The death-rate may sometimes be as high as 50 per cent.

Medicinal treatment is of no value; isolation in the shade is the best plan to adopt.

Immunity is very difficult to produce, and even infection by ticks is not effective, and animals have been known to have two attacks within a year. Blood retains its virulence for 48 hours or so, but not longer. It cannot be preserved by the addition of antiseptics. It is destroyed by heat and desiccation. The bile is non-infective and non-immunizing. Hyperimmunization produces a serum capable of conferring a very brief immunity. Double inoculation is useless.

Prevention.—Change of pasture to high veldt brings about a cessation of the disease in three weeks. On low veldt two changes at intervals of three or four weeks checks the mortality.

Starving the ticks by removing susceptible animals for a period of two years is effective, but generally not practicable.

The grazing of Persian sheep on infected land would not cause any mortality, but the infection would be kept alive in the ticks.

Burning the grass is inefficient, as ticks in crevices in the ground escape.

The only reliable method of dealing with the disease is by dipping. With a view of dealing with heartwater, sheep and goats should be dipped two or three times at intervals of ten days. But dipping to be effective must be a continuous policy of tick destruction; and to get the best results the principal host of all ticks, namely cattle, must be treated. The dipping should be practised at short intervals, as with intervals of a fortnight proper tolerance to the arsenic and proper saturation of the skin with the drug is not achieved.

The author states that in two years the worst tick infested property can be freed if the dipping be regular and thorough.

HENLEY (R. R.). **Clarification of Hog-Cholera Defibrinated-blood Antitoxin.**—*Jl. Amer. Vet. Med. Assoc.* 1922. Mar. Vol. 60. No. 6. pp. 717–723.

The method described is applicable to carbolized serum in which the haemoglobin of disrupted corpuscles has been set free.

MANN's statement that haemoglobin could be precipitated by chloroform was tested, and the results obtained at first were not satisfactory. Subsequently it was discovered that complete precipitation could be effected if the blood contained at least 0·5 per cent. carbolic acid, if the temperature of the blood did not exceed 40° F. when the chloroform was added, and if the mixture was thoroughly shaken.

The process is described in detail, and the following are the important steps :—

1. The defibrinated blood, containing 0·5 per cent. carbolic acid, is cooled to 40° F. or lower, and to 500 cc. DORSET and HENLEY's bean extract is added in the proportion of 2–3 per cent. The flask is shaken.
2. Chloroform in the proportion of 10 per cent. is then added, and the flask again shaken.
3. To be carried out only when the serum is to be separated from the clot by filtration (see later). Five grammes of salt are added and the mixture transferred to a shaking machine.
4. Shaking must be done promptly after adding the chloroform to ensure the maximum precipitating effect and to prevent the formation of a clot in the bottom of the flask. Shaking is continued for ten minutes. This produces a semi-solid clot from which light red serum will exude on standing.
5. When the serum exudes the clot is easily broken up by shaking by hand and is reduced to a more fluid consistence. Separation of the serum may be effected by centrifuging either in a bucket or "continuous" machine, or by filtration through paper. For the latter purpose special trays, and not funnels, are used. It is claimed that a 50 per cent. yield may be obtained by the filtration direct, and that a further 15 per cent. may be obtained by pressing the clot and paper in a fruit press (the clot and paper being first enclosed in a muslin bag).

Serum so obtained may be heated to 58° C. for half an hour.

A serum carbolized to 0·5 per cent. when clarified by this method is found to contain on an average only 0·2 per cent. This deficiency must be made up or the serum will not keep.

The yield is generally rather over 60 per cent. of the total volume treated.

The loss of globulins, which "carry the antitoxin," was estimated at about 10 per cent.

The process renders the serum sterile.

It is noteworthy that as the process described differs from the bean salt process only in the use of chloroform, it was not considered necessary to carry out any extended tests of the potency of the serum. In fact only one test was carried out, and the number of pigs used is not mentioned.

DUVAL (C. W.) & COURET (M.). **The Purification and Concentration by Desiccation of Hog Cholera Immune Serum.**—*Jl. Med. Research.* 1921. Oct.–Dec. Vol. 42. No. 5. pp. 503–514.

The authors state that the hog cholera serum now in use is not free from objection in that it gives a low "percentage of protection," and that in the quantity recommended by the Bureau of Animal Industry protection lasts only three or four weeks.

They hold that improved results are obtainable by using serum which has been freed from corpuscles—the hog cholera serum in use being actually carbolized defibrinated blood—desiccated, and redissolved in a small volume of solvent.

The method which they have devised is given more or less in outline only.

It is claimed that the desiccated and powdered serum will retain its potency for years, and, further, that it may be mixed with virulent serum and kept for months, the virus and the antiserum both retaining their properties.

FONTELA (J. M.). **La fiebre aftosa y su contagio a la especie humana.** [The Susceptibility of Man to Foot and Mouth Disease.]—*Revista Zootec.* 1922. Mar. 15. Vol. 9. No. 102. pp. 62–78.

MYCOTIC DISEASES.

LARIEUX. **Contribution à l'étude du traitement de la lymphangite epizootique.** [The Treatment of Epizootic Lymphangitis.]—*Rec. Méd. Vét.* 1922. Mar. 30. Vol. 98. No. 6. pp. 131–137.

A certain cavalry barracks was used during the war as a veterinary hospital, in which there were cases of epizootic lymphangitis from time to time. In spite of disinfection, cases of the disease began to make their appearance when the barracks were again occupied by cavalry after the war. The first case developed in December, 1919, and during the next 16 months 36 animals were under treatment for the disease. Five of these were given etherized pyo-vaccine, but from September, 1920, onwards all were given heated culture emulsions prepared according to the technique of BOQUET and NÈGRE. Weekly doses were given beginning with 1 cc. and increasing by 1 cc. weekly up to a maximum of 5 cc. This dose was given until recovery took place.

FORGEOT, who used this method, obtained 65 per cent. of recoveries. The author gives a tabular statement of 31 cases which came under his care. From this the following information may be gathered. The period of incubation ranged from 40 to 212 days. The number of doses of vaccine given varied from 3 to 18. The course of treatment was from 21 to 252 days. In many cases surgical treatment, such as point firing (the abscesses) and curetting, was resorted to. In ten cases the animals were slaughtered, and recovery took place in the remainder.

In no case did deep point firing of the abscesses suffice to arrest the progress of the disease.

It was observed that if obvious improvement does not take place after 8 or 10 injections, the lesions may heal up completely if the vaccination is stopped. If favourable results are not obtained the probability is that the Preisz-Nocard bacillus is also present in the lesions. It is probable that had the use of the vaccine been limited to cases for which the cryptococcus alone was responsible, the percentage of recoveries would have been higher.

In the discussion which followed, TRUCHE drew attention to the difference in the period of incubation of the natural disease and that set up by experimental inoculation. NÈGRE and BOQUET found that inoculation with pus produced lesions more promptly than inoculation with culture, the periods of incubation being 15–20 and 30–40 days respectively. The average period of incubation as given by Larieux's figures is 117, and this agrees closely with that obtained by other observers. Emphasis is laid upon the necessity of resorting to artificial culture for diagnostic purposes. Microscopic examination is held to be insufficient.

In cases of mixed infection the cryptococcus vaccine may be given first, followed by vaccines against other organisms present.

MISCELLANEOUS.

PAVLOVSKY (E. N.). **Description of a Box for Collecting and Transporting Living Insects, etc.**—*Parasitology.* 1922. Apr. Vol. 14. No. 1. pp. 47–50. With 1 text fig.

The box here described is a modification of one seen by the author at the Natural History Museum, Simpheropol, in 1911, the originator of which he has been unable to discover.

The external measurements of the box are 45 cm. by 31 cm. by 5·5 cm. The bottom is made of wire gauze with a 0·5–1 mm. mesh. The top is in three sections opening independently, hinged at one side, and supplied with suitable fastenings at the other. The interior of the box is divided by eight continuous transverse partitions which are slotted to take small partitions dividing the long compartments into six small ones. At the end of each long partition is an extra slot to take one of the cross partitions if it is desired to increase the size of one or more of the small compartments. The lid is provided with holes about an inch in diameter and each hole is provided with a cork. This is for the introduction of specimens into the box.

The small compartments may be again subdivided by plates of tin cut to suitable shape.

Such boxes may be conveniently stacked for transport, the gauze bottom of one resting on the corks of the next below it.

The figures (p. 93) show the details of construction clearly.

DODD (S.). **Tick Paralysis.**—*Jl. Comp. Path. & Therap.* 1921. Dec. Vol. 34. No. 4. pp. 309–323.

The occurrence of a form of paralysis accompanied by other symptoms is well known along the Eastern Coast of Australia, and it has been associated with the bite of a hitherto undetermined tick. In this paper the author gives details of his experiments and observations and also definitely incriminates *Ixodes holocyclus*. The disease is seen during the spring and summer, but on the more northern part of the coast it may occur in winter also.

Young animals are far more susceptible than adults, and it has been proved that a single tick is sufficient to set up the disease. Animals indigenous to the country appear to be immune, and it appears to be probable that wild animals possess a complete hereditary immunity.

The symptoms are as follows:—Dullness and loss of appetite with occasional vomition. Slight incoordination of the hind limbs which steadily advances to complete paralysis affecting all the limbs. There may be occasional convulsions. Vomition of bile-stained mucus occurs. Pulse and temperature are normal, but respiration is of the Cheyne-Stokes type. In fatal cases coma and death follow.

The paralysis appears to be purely motor. Early removal of the tick or ticks is important, as it has been proved by experiment that if the tick is removed soon after it has attached itself symptoms are not developed.

PAVLOVSKY (E. N.).

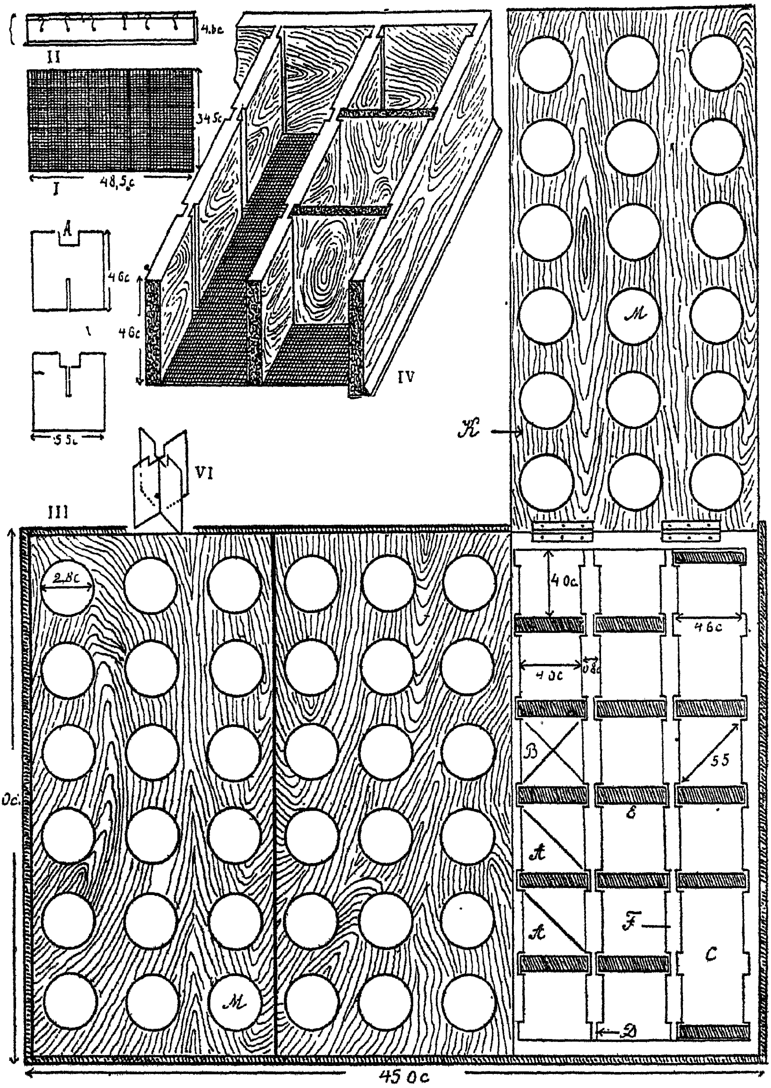

Fig. I. Bottom of original model, showing wire-gauze floor and partitions.

Fig. II. Lateral view of improved model showing hooks for fastening lid sections.

Fig. III. Plan of improved model showing lid sections, one of which is open: *A* and *B*, compartments subdivided into two or four parts respectively by the insertion of diagonal plates; *C*, double compartment formed by removal of one movable partition; *D*, space mortice; *E*, movable partitions; *M*, aperture of a compartment.

Fig. IV. Detail of the interior in perspective. The lid is not represented. The wire-gauze floor and wooden fillet are clearly shown.

Fig. V. Tin plates for diagonal partitions of compartments: *A*, incision for reception of part of cork protruding beneath the lid of the box.

Fig. VI. Pair of tin plates interlocked for fourfold subdivision of compartment.

(Reproduced by permission from *Parasitology*.)

Cases have been seen in foals, calves, cats and dogs, and it has been reported in young pigs. The author doubts whether the latter cases were really due to the tick.

The author reviews the literature dealing with Tick Paralysis as observed in Australia, and describes at some length a case reported by EATON in 1913 which occurred in a child 4½ years old, and one recorded by STRICKLAND in 1915.

Other means having failed, the author finally succeeded in obtaining specimens of the ticks by encouraging his own dog to run through bush known to harbour them and carefully searching him immediately afterwards. In this way some thirty unengorged ticks were obtained, but from one cause or another all died before they attached themselves to experimental animals with the exception of three females and one male. The results obtained with these were, however, conclusive. One was placed on a guinea-pig and death ensued on the sixth day. One was placed on a full-grown Pomeranian dog, and death took place on the ninth day. One refused to attach itself to a lamb, but attached itself to a dog when placed on it. In this case the tick dropped off on the seventh day and was lost. No symptoms developed. The last one refused to bite on a sheep and also on a dog, and it died the following day. This experiment was not satisfactory in that (1) the tick may not have been virulent, (2) the dog was a stray street dog and may have been immune either from age or from previous intoxication.

The author discusses the possible ways in which the tick may produce the symptoms described, and comes to the conclusion that although a toxin manufactured by the tick itself may possibly be the real cause, further investigation is required.

ANDREWS (W. H.). **The So-called "Staggers" or "Pushing Disease" of Cattle in Natal. An Intoxication due to the Ingestion of** *Matricaria nigellaefolia*, **D.C.**—*Jl. Comp. Path. & Therap.* 1921. Dec. Vol. 34. No. 4. pp. 263–309.

This disease, which has been recognized for many years, has until recently been looked upon as of minor importance. In 1919, however, the author personally investigated or had accurate information regarding 570 cases, of which 450 ended fatally.

A common feature of all farms upon which the disease has occurred is the presence of swamp grazing. The annual incidence of the disease is variable. In some cases a varying number of cases occurred in successive years, while in others there have been long intervals between outbreaks.

The majority of outbreaks occur in the spring soon after the burning of the veldt. The influence of meteorological conditions upon the incidence of the disease is not known, but the majority of outbreaks investigated by the author occurred under conditions of drought.

The disease appears to attack cattle only. Breed does not appear to affect its incidence. Calves have not been affected before they start grazing, and the heaviest losses occur among milch cows.

The symptoms vary in different outbreaks and individual cases. One of the earliest symptoms is a change in the eye. This protrudes, and has a glazed appearance, while the pupil is contracted. Loss of appetite, grinding of the teeth and quivering of the ears are early symptoms.

These are associated with an aimless wandering with the head held low, uncertain gait, stumbling over small obstacles and difficulty in drinking.

In the second stage the affected animal shows a peculiar tendency to push its head against any obstacle, such as a tree, post, etc., either without great force or with extreme violence. After a time there is gradual relaxation of the muscles and the animal moves away or may fall exhausted.

During this stage there may be great violence or progressive coma.

During the last stage, which may be prolonged, coma is the most marked symptom, but there may still be phases of violent movement.

Recoveries have been recorded in cases where the symptoms have not been very pronounced, but no animal having reached the stage of convulsions is known to have recovered. The course of the disease may be anything from a few days to two months, but as a rule animals are killed as hopeless a fortnight to three weeks after the onset of illness.

The almost constant lesions are:—Emaciation, petechiae and ecchymoses on the heart, a flabby condition of the heart, subcapsular haemorrhages of the liver, and venous congestion.

The mortality is rather less than 80 per cent. as far as can be ascertained from the figures available, but the mortality varies greatly from outbreak to outbreak and farm to farm.

Recovery is a very slow process and animals which have passed through an attack, it may be some years previously, are liable to become excited on very little provocation.

There is not sufficient evidence upon which to base any opinion with regard to immunity.

The second part of the paper contains a detailed account of the investigations which the author carried out with a view to determining the cause of the disease, and the manner in which *Matricaria nigellaefolia* was incriminated.

The plant thrives best in mud which is in the process of drying up, and on ploughed land when there is sufficient moisture. It is an early and energetic colonist of damp bare places.

Experiments showed that there is a period of latency after ingestion of the plant comparable to the period of incubation of a bacterial disease. The limits of this period were (1) from 23 to 47 days after the commencement of matricaria feeding, and (2) 7 to 42 days after its suspension.

Only a few preliminary experiments have been made with a view to isolation of the active principle, but there appears to be a possibility that it is an essential oil.

STOICESCO (G.). **La Méningite cérébro-spinale enzootique du cheval en Roumanie.** [Enzootic Cerebro-spinal Meningitis of the Horse in Roumania.]—*Archiva Veterinaria,* 1921. Vol. 15. No. 6. pp. 229–236.

The disease was first observed in 1918 when an outbreak occurred in a stud in Botochani, when 45 out of 100 horses had it and 40 died within a period of two months. Bacteriological examinations yielded negative results.

In June, 1921, the disease again came under observation among a number of horses and mares (with some foals) at grass. The area upon which the animals were grazing was a hillside terminating in a marsh which was partly dried up but full of reeds. Apart from this the grass was good. The first mare died after a few hours' illness with symptoms of colic on July 14. Four days later another mare died after showing symptoms suggestive of madness for three hours. During the following few days two more mares died.

On July 25 it was decided to move the animals to some empty stables near the town. By mistake the batch of animals was taken to the barracks, but was isolated. Nevertheless the disease spread to the horses of the regiment.

Of the 73 animals at pasture, ten mares, one foal and two horses died. Five cases occurred among the 610 horses belonging to the regiment and of these three died. Half the fatal cases terminated within 12 hours, and the remainder between 24 hours and 4 days.

While equine cerebro-spinal meningitis appears to have been recognized elsewhere (United States, France, Saxony, etc.), it appears to have been confounded with anthrax and typhoid infections in Roumania. Two forms of the disease are known—the peracute and the acute.

In the peracute form the disease develops in three or four hours. Affected animals are restless, appear frightened, show rigors, snort, appear to be unable to see obstacles in their path, execute incoordinated movements, and sweat Then they calm down and even become somnolent. During this stage the muscular tremors and sweating continue. The temperature rises to 38° or more. After the period of somnolence hyperexcitability appears again. Incoordination and muscular tremors and spasms are more pronounced. These affect the muscles of the head and neck particularly, causing a rigid extension of the head. The membranes of the eye are congested and may show petechiae. The pupil is dilated and its reflex is very slow. The pulse is weak and its rate is about 40 per minute.

The periods of excitement and depression follow each other at short intervals and death takes place in 6–12 hours.

In the acute form the symptoms are similar, but the periods of excitement are shorter and those of stupor longer than in the peracute form.

In cases which recover, the periods of excitement become shorter and shorter and the periods of depression longer, and gradual recovery takes place.

In acute cases the symptoms are as follows :—loss of appetite, indications of colic, trembling of certain muscles, particularly those of the abdomen. The periods of excitement are less frequent than in peracute cases, and intervals of stupor lasting 10–15 hours may intervene. The mucous membrane of the eyes is congested and the eyes are half closed. Lachrymation is marked. Urine is evacuated with difficulty, and it has a stringy, oily consistence. In some cases it may be blood tinged, and incontinence of urine is sometimes seen.

After two or three days symptoms of pulmonary congestion make their appearance, and three or four days later death occurs.

At the post-mortem examination no lesions characteristic of the disease are discoverable. Gelatinous oedema of the connective tissues and ecchymoses of the mucous membranes are frequently found. If pneumonia has supervened the lesions will be present. Putrefaction is very rapid. The contents of the intestines are tinged with blood. The spleen is enlarged and shows evidence of small haemorrhages. Congestion of the brain and cord, dropsy of the lateral ventricles, congestion of the pineal and general oedema are the lesions found in the central nervous system. The disease does not appear to be transmitted by direct contact, and the period of incubation varies from 5–14 days.

A Gram-negative diplococcus has been isolated from the central nervous system. This is easily cultivated outside the body. The addition of serum improves culture media for it. Broth is not rendered turbid. Glucose, laevulose, lactose, and dextrose are not fermented; maltose is.

Intraperitoneal inoculation of guinea-pigs produces non-fatal peritonitis, and intracranial inoculation of rabbits fails to produce any symptoms of meningitis.

The diplococcus is agglutinated by normal horse serum in a dilution of 1 in 10, and that of a recovered animal causes agglutination in 1 in 40 to 1 in 25.

Horses inoculated intravenously with 1–2 cc. of blood taken from a case immediately after death have failed to become infected.

DONATIEN (A.) & BOSSELUT (R.). **Encéphalite aigue contagieuse du boeuf.** [Contagious Bovine Encephalitis.]—*Rev. Gén. Méd. Vét.* 1922. Apr. 15. Vol. 31. No. 364. pp. 185–191.

In this paper the authors describe a contagious disease which made its appearance in a herd of cattle in Marengo during the period September 10 to November 5, 1921.

The clinical aspect of the disease was as follows :—Affected animals fell into a kind of stupor which in about half the cases was interrupted by periods of excitement.

All the affected animals were in poor condition. It was noted that a stringy saliva trickled from the lips and that the pupils of the eyes were dilated. Frequent, but generally unavailing, efforts were made to defaecate. At times a small quantity of faeces covered with mucus was evacuated. Urination on the other hand was frequent and abundant. There was no fever. Loss of condition was rapid and death took place on the second or third day as a rule. Out of a herd of 20, 10 became affected and 9 died.

At the post-mortem the rumen was found to be full and the intestines empty. There was no evidence of obstruction in the omasum. In two cases there was marked softening of the splenic pulp. The urine contained albumen but no sugar.

To the naked eye all the organs appeared healthy. This was confirmed histologically in the case of the liver, kidneys, and lymphatic glands.

Diagnosis.—The absence of motor paralysis and glycosuria excluded rabies. Aujeszky's disease was likewise excluded by the absence of pruritus. A complete change of diet was without effect.

The stupor, mydriasis, paralysis of the rumen, and rapid termination suggested some diseased condition of the medulla.

Microscopic and cultural investigations failed to reveal any organism.

Inoculations with urine, pericardial fluid, lymphatic glands, and salivary glands have yielded negative results.

Proof as to the virulence of the nerves, blood, and spleen pulp is not yet forthcoming, as second passages have not yet been obtained.

The brain, spinal cord, and retina are virulent. Two calves inoculated into the anterior chamber of the left eye died thirteen days later with clear symptoms of encephalitis. Two rabbits inoculated intramuscularly with emulsion of the retina of the right eye of each of these calves were found paralysed on the fourteenth day and dead on the day following.

The virus retains its virulence in neutral glycerin for a fortnight if kept in the dark at 15° C. Desiccation does not destroy it under the same conditions in ten days.

A rabbit inoculated intramuscularly with a brain emulsion filtered through a Chamberland filter (Chamberland L.1 *bis*) died with typical symptoms on the sixteenth day.

An emulsion of the medulla of this rabbit injected intramuscularly into two others produced paralysis in thirteen days and death two days later. The virus is therefore filtrable.

Four passages through rabbits failed to modify the virus for the rabbit, but produced attenuation for the calf.

Passage through dogs exalts the virulence for that species, death taking place in the first passage at 21, in the second at 18, and in the third at 13 days.

All species used so far have proved to be susceptible to the virus, viz., calves, rabbits, dogs, sheep, monkeys and guinea-pigs. In all these at least two positive passages have been obtained. A donkey succumbed, with typical symptoms, to inoculation with calf virus, and rabbits inoculated from the donkey contracted the infection.

The virus is transmissible by practically all methods of inoculation.

A sheep inoculated subcutaneously failed to become infected (single experiment).

The period elapsing between inoculation and death varies with the species and with the quantity and source of the virus.

It is noted that the period is very variable in the guinea-pig (six days to two months).

The symptoms vary with individuals and the method of infection.

Intramuscular inoculation usually causes myelitis, followed by cranial symptoms and death. Subdural and intraocular inoculation cause symptoms of brain disturbance from the outset.

The symptoms generally seen in the different species are :—Abundant salivation, variable temperature terminating in high fever, Cheyne-Stokes respiration, and indications of medullary involvement, such as spasms, inco-ordination of movement, hyperaesthesia and paralysis.

The most constant feature of the disease experimentally produced is its extreme rapidity of development, which with very few exceptions does not exceed 24 hours. Another notable feature is the complete absence of paralysis in those exceptional cases which run a more prolonged course.

With regard to the lesions it is important to note the absence of sugar in the urine, while albuminuria is fairly constant.

The only clear lesions are to be found in connexion with the nerve tissues.

The membranes are very congested, the spinal fluid is abundant and slightly turbid. On centrifugation the sediment shows numerous lymphocytes, some mononuclears, and frequently red corpuscles. Punctiform haemorrhages are found throughout the nerve tissues, particularly in the mid-brain.

Histological examinations have revealed perivascular infiltrations with lymphocytes, chromatolysis, and vacuolization of the nerve cells, destruction of the neurons either by leucocytes or, in the nerve ganglia, by proliferation of the cells of the sheaths of the ganglion cells.

Intracellular bodies of an undetermined nature have been detected in various parts of the nervous system.

PHILLIPS (E. P.). **A Possible Cattle Food.—Seeds of** *Sesbania cinerascens,* **Welw., and** *S. mossambicensis,* **Klotz.**—*Jl. Dept. Agric. (South Africa).* 1922. Apr. Vol. 4. No. 4. pp. 361–365. With 1 plate.

Of the 23 species of Sesbania known to occur in Africa six are found in South Africa. Two of these have been examined by the Imperial Institute in London, and the reports would appear to warrant further investigation as to their food value for cattle. Heavy crops of seeds have been obtained from trial crops. The genus belongs to the Leguminosae, the leaves are always pinnate, and the flowers mottled, striped, or pure yellow or blue.

Reports on the two species examined at the Imperial Institute are given in detail.

Pending experiments, no opinion can be expressed as to the actual feeding value, but judging from the analysis it appears that the seed might be used in place of peas, lentils and millet. A further point which can only be settled by investigation is the possible effect of minute traces of alkaloid.

HOESEN (H. W.). **Rat-Plague Indicators in Java.**—*Meded. Burg. Geneesk. Dienst Ned.-Indië.* Batavia. 1920. viii. pp. 2-89. [Reviewed in *Rev. App. Entomol.* 1922. Apr. Vol. 10. Series B. No. 4. p. 75.]

As a result of investigations carried out in Java, SWELLENGREBEL stated that a certain relation appeared to exist between an increase of fleas in a given district and the occurrence of rat plague there.

There are three "indirect" indicators of rat plague, viz., the flea-index, the percentage of rats carrying fleas, and the ratio of such rats to those carrying trypanosomes and being shorter than 150 mm. (*i.e.,* young animals not yet immune to trypanosomiasis). With an outbreak of rat plague the percentage of flea-carrying rats would increase as a result of concentration of fleas upon living rats, while that of trypanosome-carrying rats would remain constant, as the infection with *Trypanosoma lewisi* appears only after a week or two, and plague-infected rats would have died before that.

It does not appear to be possible in Java to decide solely from the indirect indicators whether there is an epidemic occurring or not, though it may be possible to diagnose rat plague on indirect lines by a method of grouping the figures obtained from the flea-index and the percentage of flea-carrying rats.

MOUQUET (A.). **Contractions musculaires cloniques chez l'éléphant.** [Clonic Muscular Spasms in the Elephant.]—*Rec. Méd. Vét.* 1922. Jan. 30. Vol. 98. No. 2. pp. 49–51.

The subject was a female elephant from Indo-China, about 21 years old. It was known to have shown slight muscular contractions at the time when it first came under observation at the age of two years, but no particular note of their occurrence was made. Change of food, occasioned by the war, produced a marked loss of condition, and simultaneously muscular spasms became pronounced. The abdominal muscles showed contractions numbering up to 60 per minute. It seemed that the diaphragm as well as the abdominal muscles were concerned. Similar contractions were observed in the extensors of the radius. Improvement in the condition of the animal resulted from a more suitable diet. After an interval of several months it was impossible to avoid another change in the diet, and shortly afterwards spasms of the muscles of the lower part of the neck were observed.

With a return to a proper diet improvement again set in.

ÉLOIRE (A.). **La Tuberculine diluée se conserve-t-elle longtemps?** [Does Dilute Tuberculin retain its Properties for Long Periods?] —*Rec. Méd. Vét.* 1922. Apr. 15. Vol. 98. No. 7. p. 200.

The author always uses dilute tuberculin for tests, by all methods. Dilute tuberculin in bottles with rubber stoppers which he had in his possession in 1914 was brought into use again in 1919, and was still giving satisfactory reactions seven years after it was originally obtained. In the interval the bottles had been kept in cold storage wrapped in red paper.

[Details of tests are not given.]

MUNDY (H. G.) & BLACKSHAW (G. N.). **Grasses of Agricultural Importance in Southern Rhodesia.**—*Rhodesia Agric. Jl.* 1922. Apr. Vol. 19. No. 2. pp. 134–149. With 12 plates.

VELU. **Note sur les lésions dentaires observeés sur les Mammifères de la Haute Chanoia.** [Dental Lesions of Mammals observed in Haute Chanoia (Morocco).]—*Maroc Médical.* 1922. Jan. 15. No. 3. p. 107.

REPORTS.

SOUTHERN RHODESIA. **Report of the Chief Veterinary Surgeon for the Year 1921. (With Report of the Veterinary Bacteriologist.)** [SINCLAIR (J. M.), Chief Vet. Surgeon, & BEVAN (Ll. E. W.), Govt. Vet. Bacteriol.]—10 pp. 1922. Salisbury, Rhodesia: Printed by the Government Printer.

African Coast Fever.—The Chief Veterinary Surgeon reports that the state of affairs is more satisfactory than at any time since the importation of the disease in 1901, but he does not think that complete eradication is in sight. His reason is that over and over again recrudescences have occurred in inexplicable manners in unsuspected districts. Emphasis is laid upon the necessity of maintaining the present regulations with the greatest stringency and of early detection of the disease. An increase of 240 in the number of dipping tanks is reported, bringing the total up to over 2,000. Inspectors are now provided with the apparatus necessary for checking the composition and strength of the dips used.

Contagious Abortion.—This disease was detected in 94 herds—an increase of 58, but this is not believed to represent the prevalence of the disease, as it is certain that many infected herds have not been reported. Detection of individuals and isolation are impracticable, and for the present vaccination and general prophylactic measures must be relied upon.

Quarter Evil.—This occurs in all districts and at all times of the year, but mainly during the winter. The mortality was 3,142. " All vaccines have been discarded in favour of aggressin and Leclainche-Vallee's liquid preparation, both of which have given most satisfactory results."

Swine Fever.—An outbreak occurred in the Lomagundi district; 29 animals died and the remainder were killed.

REPORT OF THE VETERINARY BACTERIOLOGIST.

Contagious Abortion.—Outbreaks have occurred which apparently originated with the introduction of a new bull into the herd. Two hundred and two bulls have been tested, and of these 9·4 per cent. gave positive reactions to the agglutination test. The devitalized vaccine has proved to be valuable and its continued use is justified. Attention has been forcibly drawn to the danger of expecting the disease to " wear itself out." In Rhodesia the " disease assumes a chronic form in a herd, and although abortions are rarely detected, the low calf crop and the large number of sterile cows indicates its presence."

Attention is drawn to the possibility of human beings becoming infected from cattle suffering from contagious abortion.

Horse Sickness.—Of 110 horses subjected to protective inoculation six died, a smaller percentage than in the two preceding years. Approximately the same percentage of horses belonging to the British South Africa Police died of horse sickness during the year.

EGYPT. **Ministry of Agriculture. Veterinary Service. Annual Report for the Year 1920–21** [LITTLEWOOD (W.), Director.] —pp. 73 + v. 1922. Cairo: Govt. Press. [Price P.T. 5.]

This report is divided into five sections dealing respectively with (1) Disease of Animals, (2) Veterinary Pathological Laboratory, (3) Provincial Inspectorates and Quarantines, (4) School of Veterinary Medicine, (5) Serum Institute.

1. During the year 41,676 animals were doubly inoculated against rinderpest, with 47 deaths. Ten animals which had been protected by double inoculation in 1912 were tested with 5 cc. of proved virulent blood. None reacted.

The value of the method for the inoculation of calves is under examination.

Eighty-three cases of rabies occurred during the year.

Glanders was detected in 51 cases, as against 106 the previous year.

Epizootic lymphangitis, anthrax and sheep-pox all showed reductions in numbers as compared with the previous year.

Trypanosomiasis of camels, piroplasmosis and tuberculosis all showed increases.

Section 2.—Although buffaloes may show clinical symptoms of piroplasmosis, and their blood may exhibit the changes associated with that type of infection, as yet parasites have not been discovered. The buffalo enjoys a remarkable freedom from ticks as compared with cattle.

Egyptian fever was first detected in a buffalo in April, 1920. This is not a piroplasmosis but a theileriasis.

East Coast fever has not been detected in Egyptian cattle, but in Sudanese cattle in quarantine. Although systematic collection and

Hunting's Art of Horse-Shoeing. 4th Edition, Revised and Edited by A. B. MATTINSON [O.B.E , M.C., F.R.C.V.S., D.V.S.M., etc.]. —pp. viii + 223. With 169 figures. 1922. London: Baillière Tindall & Cox. [Price 10*s*. 6*d*. net.]

Hunting's "Art of Horse-shoeing" was originally written for three classes of readers: for horse owners having an interest in the subject, for farriers who are open to conviction, and for veterinary students who have to be examined on the shoeing of horses The greater part of practical farriery was carefully described by a very acute observer—the late William Hunting. He held strong views on horse shoeing, and he had sufficient courage to express them more or less emphatically and sometimes dogmatically according to his estimate of the immediate importance of the section under discussion. On many points he did not agree with the accepted teaching, but he always gave excellent reasons for differing from the recognized authorities on the subject. He had given more attention than most veterinary surgeons to the practice of shoeing and his first little book was based on long, earnest observation of good and bad shoeing of horses in London. His work has stood the test of time and it merits permanence as a clear, crisp and reliable guide to the best methods of shoeing horses. The first edition was highly appreciated by veterinary surgeons and by farriers who were willing to improve their knowledge of the subject. This issue was followed at short intervals by a second and a third, and now, owing to the sustained popularity of Hunting's instructions, a fourth edition, revised and edited by Major Mattinson, has been produced. It is more comprehensive than any of its forerunners, and although the additions may not be considered as of first-rate importance they were required to complete the work as a text-book. The editor has succeeded in producing a trustworthy book on a subject which still claims much attention from those engaged with horses. It is fully illustrated and very well printed on excellent paper. Altogether it may be regarded as the most direct exposition in English of the art of shoeing horses.

J. Macqueen.

TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY BULLETIN.

VOL. 10.] 1922. [No. 4.

DISEASES DUE TO PROTOZOAN PARASITES.

SERGENT (E.) & DONATIEN (A.). **Les Stomoxes, propagateurs de la trypanosomiase des dromadaires.** [Stomoxys, the Transmitting Agents of Trypanosomiasis of the Dromedary.]—*Compt. Rend. Acad. Sci.* Paris. 1922. Feb. 20. Vol. 174. No. 8. pp. 582–584.

The authors' experiments have shown that in the dromedary trypanosomiasis can be spread by the direct method by flies of the genus Stomoxys. The paddock in which the observations were made had been used for dromedaries before without any extension of trypanosomiasis from diseased to healthy being observed. In 1920, however, Stomoxys, and Stomoxys only, were found there. These flies were noted to go from animal to animal and bite before settling down to a full meal of blood.

Parallel experiments were carried out with guinea-pigs. Flies failed to transmit the trypanosome from the diseased to healthy guinea-pigs when intervals of from one day onwards intervened between the bites. When, however, the flies were transferred direct from the infected to the healthy guinea-pigs, six out of twelve became infected.

No evidence of development of trypanosomes could be found in the flies.

CROSS (H. E.) & PATEL (P. G.). **A Note on the Transmission of Surra by Ticks.**—*Depart. of Agric., Punjab, Veterinary Bull. No. 6.* 1921. pp. 1–3.

The authors have come to the conclusion that the spread of surra cannot be confined to winged and comparatively short-lived flies. This conclusion is based upon the following observations:—

1. Surra breaks out frequently in the same district and stables, though, so far as can be ascertained, the disease has not been imported into that district.

2. In one outbreak of surra the disease first made its appearance among ponies kept in a certain stable. For two years this stable was not used; two years later, when ponies were again placed in it, cases of surra appeared.

The ponies were, so far as could be discovered by enquiries, perfectly healthy when placed in the stable, and had not come from an infected area. Further, no animals were known to be suffering from surra in the vicinity of the stables at the time the ponies were imported. The authors conclude from this that if the infection was not contracted while the animals were at work, they must have acquired the infection from some reservoirs of the disease which had survived for two years.

Up to the present the only species of Ornithodorus recorded in India are *O. lahorensis* (in the Punjab) and *O. savignyi* in Gujerat, Bombay, Central Provinces and Madras. Cross, however, has found a species resembling *O. lahorensis* in large numbers in the Murree Hills. This tick has been identified by BRUMPT as a new species, *O. crossi.* It was with this tick, and in a few cases with *O. lahorensis* also, that the experiments indicated in this paper were carried out.

The ticks were fed upon camels showing numerous trypanosomes in their blood, and of these some were interrupted in their feed and placed upon healthy animals within 1–20 minutes to finish, while others, having completed their feed, were placed upon healthy animals after intervals ranging from 5–22 days. Those which had had their feed interrupted were placed upon healthy animals after an interval of 34 days. In no case was surra transmitted.

When tested after 46 days the ticks which had completed their meal again gave negative results.

After 67 days, 42 ticks, comprising both those which had completed their meal and those which had not, together with two specimens of *O. lahorensis* which 22 days previously had fed upon an infected animal, were fed upon a healthy rabbit. Ten days later trypanosomes were found in the blood.

After a further 16 days, 36 of the *O. crossi* were again fed on a clean rabbit, and the two *O. lahorensis* were fed, at 14 days' interval, on a white rat. The rabbit showed trypanosomes on the 11th day and the rat was negative up to nine weeks.

The ticks were fed after a further interval of 18 days on a healthy rabbit, and eight days later trypanosomes were discovered.

The seasonal occurrence of surra may be due to the fact that many species of ticks hibernate during the colder months. The suggestion is put forward, therefore, that ticks may act as reservoirs for surra and that an outbreak having been started by ticks is carried on by flies.

It is admitted that the paper is far from complete.

DONATIEN (A.) & PARROT (L.). **Trypanosomiase naturelle du chien au Sahara. Note Préliminaire.** [Naturally Contracted Trypanosomiasis of the Dog in the Sahara. Preliminary Note.]—*Bull. Soc. Path. Exot.* 1922. July. Vol. 15. No. 7. pp. 549–551.

After referring to the discovery of canine trypanosomiasis in the Sahara by VIALATTE, DELANOË and VELU, the author describes a case encountered at Touggourt.

The case ran a course of about three months from the time that symptoms were first observed. The general symptoms were those of trypanosomiasis, with opacity of the cornea of both eyes.

Trypanosomes were present in large numbers in the blood at the time of death.

The parasite is described as long and slender. Detailed measurements are given.

Inoculation of mice produced a fatal result in 11 days, parasites making their appearance in the blood two days after inoculation and increasing without intermission up to the time of death.

Rabbits and guinea-pigs have been infected. The results of cross-immunity tests will be published later.

The author believes it to be a natural case of " el debab " in the dog.

HOARE (C. A.). **Trypanosomiasis in British Sheep. Preliminary Note.** —*Trans. Roy. Soc. Trop. Med. & Hyg.* 1922. June. Vol. 16. No. 3. pp. 188–194. With 1 text fig.

The author refers to the work done by WOODCOCK, BEHN, FLU, SWINGLE, PORTER, NÖLLER and KLEINE, in connexion with the occurrence of trypanosomes in domestic sheep and Crithidia in sheep keds, and the possible relationships between the two.

Interest in the matter was revived by NÖLLER's cultivation of trypanosomes from the blood of German sheep and his identification of the parasite with the so-called *Crithidia melophagia,* and also by KLEINE's (1919) proof that laboratory-bred keds contained no flagellates, that keds fed upon sheep harbouring trypanosomes acquired them, and that keds could not transmit flagellates to each other either through the faeces or the ova. His supposition was that sheep were infected through the bites of keds, as he found slight infections of the proboscis with trypanosome forms in about 4 per cent. of the keds examined. In 1921 the author succeeded in cultivating trypanosomes from the blood of 80 per cent. of a flock of 50 in Hertfordshire.

In the spring of 1922 he succeeded in obtaining three lambs which could not have had a ked upon them at any time. Their blood was cultured once a week for a month. As a control of the medium cultures were made from sheep having keds, and these always showed trypanosomes.

Two lambs were used for experiment and the other for control.

The first lamb had between 200 and 300 keds placed upon it, and though the blood was examined daily no trypanosomes were found. A culture was made a week after the experiment began and trypanosomes were obtained in it after a week at 30° C.

To ascertain the manner of infection, which it was thought probable was by ingestion of keds, the abdomens of 50–60 keds were mashed up in saline solution and given to the other lamb *per os.* Live trypanosomes were found in the blood on the 18th day and positive cultures were obtained.

Keds taken from the first lamb were allowed to bite the third lamb through gauze for an hour on four alternate days. Four batches of about 40 keds were used on each occasion. This lamb failed to become infected, showing that known infected keds do not transmit trypanosomes by biting.

The study of the cycle of development of the trypanosome is not yet complete, but the author has found that the parasite which occurs in crithidial form in the mid-gut becomes a small trypanosome in the hind-gut. The cycle is comparable apparently to that of *T. lewisi* in the flea.

The trypanosome as it occurs in the sheep is referable to the Theileri group in that it is large (47μ), the posterior end is pointed, the free flagellum is short, the nucleus is near the middle of the body, and the kineto-nucleus is close to it.

Pure cultures have been obtained from the ked and the sheep and have been maintained for nearly a year. They are identical morphologically. They will not grow at temperatures below 30° C., and fail to develop in N.N.N. medium. The older the cultures are the greater the proportion of trypanosome forms present.

The sheep trypanosome and the Crithidia of the ked should be named *Trypanosoma melophagium.*

Attempts to infect sheep and laboratory animals by inoculation with cultures of the sheep trypanosome failed. The trypanosome does not appear to be pathogenic for sheep, but it is suggested that it may play some part in the condition resulting in sheep and more particularly in lambs when they are heavily infested with keds, and that in some other conditions the balance between the powers of resistance and the trypanosome may be disturbed, thus permitting the latter to gain the upper hand.

PFEILER (W.). **Prophylaxe bei Beschälseuche.** [Prophylaxis against Dourine.]—*Mitteil. d. Tierseuchenstelle der Thüringischen Landesanstalt f. Viehversicherung.* 1922. Jan. Vol. 2. No. 2. pp. 13–15.

It has been found possible to protect small animals against trypanosome infection for periods up to 200 days by means of " Bayer 205." Opportunity has not presented itself of trying the drug in practice upon horses owing to the stringent application of the veterinary police regulations. Some experiments have, however, been carried out on large animals at the Institute.

Two grams of " Bayer 205 " were injected intravenously into a stallion (which was severely affected with mange), and two days later the blood of a mouse, which was heavily infected with trypanosomes, was injected intravenously. Trypanosomes were not discoverable in the blood subsequently, but wasting and swelling of the testicles were observed, and antibodies were discoverable in the serum. It appeared, therefore, that no protection had been conferred by the drug.

In the second experiment a year-old donkey stallion had injected into its urethra and rubbed into its glans penis a suspension of guinea-pig blood which was rich in trypanosomes after it had received an " infusion " of " Bayer 205." Infection failed to occur.

Two and a half months later 4 g. of "Bayer 205" were given, followed by an intravenous injection of guinea-pig blood containing trypanosomes. At the time of writing, three weeks later, no evidence of infection could be detected. Further observations on this animal are promised.

It is advised that a single dose of 6 g. of " Bayer 205 " be given as a protection during the covering season. In order to prevent the occurrence of pododermatitis 3 g. should be given first, and if no symptoms appear a second dose of 3 g. eight days later. Three grams may also be given from four to six weeks after the first 6 g.

PFEILER (W.). **Kasuistische Mitteilungen über ein auscheinendes Versagen der Bayer 205.—Behandlung bei an natürlicher Beschälseuche leidenden Pferde.** [Regarding the Apparent Failure of "Bayer 205" in some Cases of Horses naturally infected with Dourine.]—*Centralbl. f. Bakt.* 1. Abt. Orig. 1922. Mar. Vol. 88. No. 1. pp. 48–53.

This paper contains a detailed review of a number of cases of dourine treated with " Bayer 205 " in which cures were not effected.

REYNOLDS (F. H. K.) & SCHOENING (H. W.). **The Precipitation of Colloidal Gold in the Cerebrospinal Fluid of Horses with Dourine.**—*Jl. Infect. Dis.* 1922. July. Vol. 31. No. 1. pp. 59–63.

The success following the application of the colloidal gold test devised by LANGE for the classification of affections of the central nervous system led the authors to try it in dourine, which in certain stages is characterized by degeneration of the peripheral nerves and of the intervertebral ganglia.

Thirty-three samples of cerebrospinal fluid taken after slaughter were examined. Complement fixation tests and globulin tests were carried out and the sediment of the fluid was examined for trypanosomes. None were found in any of the samples.

The results of the tests are set out in tabular form and the animals are grouped according to these. The colloidal gold test was found to give reactions in many instances, some of which were similar to those of cerebrospinal syphilis. The cords were not available for microscopic examination, but in view of the positive complement fixation tests it appears to be probable that the reactions had some significance.

BESSEMANS (A.). **Valeur comparative des Techniques de préparation de l'antigène destiné à la réaction de Bordet-Gengou pour la diagnostic de la dourine.** [The Comparative Value of the Different Methods of Preparing Antigen for the Bordet-Gengou Test in the Diagnosis of Dourine.]—*Compt. Rend. Soc. Biol.* 1922. Feb. 4. Vol. 86. No. 5. pp. 289–292.

The author describes briefly methods of preparing antigen from extracts of organs of animals clean of trypanosomiasis and extracts of blood of heavily infected animals, and discusses the value of each.

He comes to the conclusion that aqueous or alcoholic extracts of organs are too feeble antigenically and too irregular in strength to be of any value for the routine diagnosis of dourine by the Bordet-Gengou test. The only two extracts of virulent blood which are reliable are those of Levaditi-Watson and Mohler-Reynolds. The former is one of partial centrifugation and the latter of haemolysis, and of the two the latter is preferable because it furnishes a far larger number of useful doses.

VAN SACEGHEM (R.). **Sérotherapie des Trypanosomiases Animales.** [The Serum-Therapy of Animal Trypanosomiases.]—*Compt. Rend. Soc. Biol.* 1922. Mar. 4. Vol. 86. No. 9. pp. 515–516.

The author thinks that in subacute or chronic cases of trypanosomiasis antibodies are developed and that the serum of such animals has protective properties. These powers are, however, of little value against the infecting trypanosomes because they "vaccinate themselves" against the antibodies as they are produced. It has been observed in many cases that trypanosomes disappear from the blood and may remain absent up to the death of the animal, but that some of them escape destruction in the blood and, being unable to maintain their existence there, pass into the cerebrospinal fluid, where they appear to be protected by specific antibodies.

van Saceghem (R.). **La Sérothérapie dans le traitement des Trypanosomiases.** [Serum-Therapy in the Treatment of Trypanosomiases.] —*Compt. Rend. Soc. Biol.* 1922. May 6. Vol. 86. No. 16. pp. 981–984.

The author has been able to follow the course of several cases of trypanosomiasis in sheep produced experimentally by *T. ruandae.* Sheep possess a slight susceptibility to this infection only, and it takes a very chronic course and terminates in recovery. The author thinks that this recovery appears to be due to the existence of some " obstructive " (empêchante) power which prevents the trypanosomes from multiplying and from invading the central nervous system. He has been able to transmit this power to goats, which ordinarily are very susceptible to infection with *T. ruandae.*

In a previous publication the author has shown that trypanosomes stimulate the production of antibodies in the body, but immunize themselves against these as they are produced. When an animal recently infected with trypanosomes is frequently injected subcutaneously with large doses of serum obtained from an animal which has been infected for several weeks, it acquires this obstructive power. As a result a chronic type of the disease is produced, which terminates in recovery. Attempts to reinfect such animals have failed, but the duration of the immunity has not been determined.

By direct transmission of 500–1,000 cc. of blood from a goat which had been infected, and which had been cured by serum injections into an infected goat, trypanosomes were cleared from the circulation within 24 hours. It was not possible to ascertain whether the disappearance was permanent, as the goat died accidentally. [From this statement it would appear that the experiment was tried in one instance only, yet the dose of blood transfused is very indefinitely given.]

Landbergen (K.). **Trypanosomen en lage temperaturen.** [The Effects of Low Temperatures upon Trypanosomes.]—*Tijdsch. v. Vergelijkende Geneesk. enz.* 1922. Aug. 5. Vol. 7. No. 4. pp. 236–240. [French and English Summaries, pp. 240–243.]

T. lewisi maintains its motility in an ice-box for 50 days, but is infective up to 43 days only.

At −20° C. feeble movements were visible after 80 minutes, but the parasites were non-infective.

A similar result followed an exposure of one hour to a temperature of −30° C.

In liquid air (about −190° C.) both motility and infectivity were maintained for one hour, but both were lost after two hours.

T. evansi, at 4–8° C., motile up to five days, not infective after four days.

At −20° C., still motile after 2½ hours. Infectivity doubtful, as the strain was avirulent.

At −190° C., motile up to 19 minutes. Produced no evident illness in mice (avirulent strain, as above), but conferred immunity against a virulent strain).

T. equiperdum. In ice-chest, infective up to two days, motile up to five.

At −20° C., non-motile and non-infective in about three hours or less.

At −40° C., non-motile after 1½ hours, but still infective at 2½ hours.

At −145° C., non-motile after 45 minutes, but still infective.

At —190° C., still motile and infective after 31 days.

T. venezuelense.—At 4–8° C., infective and motile up to 3–4 days.

At —20° C., infective after three hours, but not certainly motile after 2¼.

At —190° C., motile after 30 days and infective up to 60.

T. brucei. 4–8° C., motile and infective up to three days.

Similar result at —20° C.

At —190° C., motile and infective after 11 days.

BRUMPT (E.) & LAVIER (G.). **Mode d'action du "Bayer 205" sur divers hématozoaires: Trypanosomes, Piroplasmes, Theileries, Anaplasmes.** [The Action of "Bayer 205" on Trypanosomes, Piroplasms, Theileriae and Anaplasms.]—*Bull. Soc. Path. Exot.* 1922. July. Vol. 15. No. 7. pp. 613–621.

The authors summarize the literature which has already appeared regarding the use of this drug and give an account at some length of their own investigations.

Although the composition of the drug has not been published, it is stated by the makers to contain neither mercury nor arsenic, and is described as a fine white powder slowly but completely soluble in cold water to form a 10 per cent. solution. The solution is odourless, slightly bitter and neutral. It keeps if protected from light, and can be sterilized without undergoing any alteration. The particular sample received by the authors did not agree with this description in that the powder was pale pink in colour and both it and the solution possessed a distinct acetone-like smell.

The trypanosome experiments were carried out with *T. brucei*, *T. rhodesiense* and *T. venezuelense*. Experiments with *T. evansi* and *T. cruzi* have been postponed, as strains sufficiently virulent for experiments were not available.

With *T. rhodesiense* and *T. venezuelense* the authors have not found any change in morphology or activity after 1½ hours' exposure to the drug.

In mice which were heavily infected and within a few hours of death, 0·5 mg., either by subcutaneous or intraperitoneal injection, has always sufficed to effect a complete cure. When the dose was reduced to 0·1 mg. trypanosomes disappeared, but were again present 14 days later and death occurred in three weeks. With 0·05 mg. there was a temporary reduction in the number of trypanosomes only.

By intraperitoneal injection the drug effects the disappearance of trypanosomes in about one-sixth the time required by subcutaneous injection (5 hours to 30 hours).

The trypanosomes do not appear to present any marked changes while under the action of the drug. In stained smears stumpy forms are frequently seen, but these are possibly produced artificially in spreading films owing to the increased fragility of the parasites. The trypanosomes are, however, avirulent. A fresh mouse inoculated intraperitoneally with blood from a *brucei*-infected mouse which had been treated 22 hours previously failed to become infected, although trypanosomes were still numerous in the material used.

Smears of blood made just as the trypanosomes are disappearing may show them ingested by large mononuclear leucocytes, but such specimens are rare, and the bulk of the phagocytosis must take place in the internal organs.

Rabbits infected with *T. rhodesiense* and *T. brucei*, showing swelling of the face, conjunctivitis, eczema, and ulceration of the skin, treated intravenously with 0·2 mg., recovered within a week.

The protective properties of the drug were also tested. Doses of 1 mg. [defective type in the original makes it difficult to be certain of this figure.] protected mice against *T. venezuelense* and *T. brucei* when they were inoculated on the 18th and 16th days, but a dose of 1 cg. failed to protect a mouse inoculated with *T. brucei* on the 26th day, although the course of the disease was longer than normal.

Reinfections.—A mouse inoculated with *T. venezuelense* received 1 mg. of "205" on the fourth day. A month later it was reinoculated with the same strain. Trypanosomes appeared two days later and death occurred on the sixth day.

A second mouse treated in exactly the same way became reinfected, but the trypanosomes disappeared from the blood in six days. They reappeared, however, and the mouse died 19 days after their disappearance. The author thinks that the prolonged course of the infection in this case was due to a partial immunity established during the first infection.

Piroplasmosis Experiments.—A cow, inoculated with a mixture of viruses comprising *P. bigeminum*, *P. argentinum*, *Theileria mutans*, *Anaplasma marginale*, and possibly also *A. centrale*, showed Theileria in its blood on the 23rd day. It was given 4 g. of "205" intravenously in 10 per cent. solution. Theileria was still visible in the blood three months later.

A similar result was obtained with a calf treated in exactly the same manner.

A dog infected with a French strain of *P. canis* was given 0·5 g. of "205" subcutaneously. Considerable oedema was developed at the seat of injection. Parasites were more numerously present in the blood. A second dose of the same size was given intraperitoneally. Death occurred from piroplasmosis a few hours later.

The drug was tried in two cases of anaplasmosis of Tunisian origin. The drug had no effect upon the course of the infection, but it is noteworthy that a four-months-old calf tolerated a dose of 4 g. in 10 per cent. solution intravenously.

MASON (F. E.). **Egyptian Fever in Cattle and Buffaloes.**—*Jl. Comp. Path & Therap.* 1922. Mar. Vol. 35. No. 1. pp. 33–39.

This paper contains further observations regarding the occurrence of this disease and goes to refute the statement that has been made to the effect that East Coast fever occurs in Egypt. The author has detected this disease in Sudanese cattle arriving in quarantine, but not in Egyptian animals. BRUMPT has stated that East Coast fever exists in Egypt and that its transmitting ticks are *Rhipicephalus simus* and *Rhipicephalus bursa*. The author has collected ticks systematically for years and has had them identified by NUTTALL and GOUGH. These two species have not been detected.

Egyptian fever occurs in chronic, subacute and acute forms.

In the chronic form there may be no symptoms save a rise of temperature and slight enlargement of superficial glands. Blood examinations reveal the presence of the parasite. Such animals, kept under observation for long periods, have been observed to have recrudescences of fever from time to time associated with the presence of the parasite in the blood. Under adverse conditions it may assume the subacute or acute form. This sharply distinguishes the condition from East Coast fever.

It has been proved by observations made by the author that calves may become infected between the ages of two and six months. The disease is widely spread in the delta, and it is probable that a high percentage of animals become infected early.

The ticks usually found in association with the disease are *Margaropus annulatus*, *Hyalomma aegyptium* and *Boophilus australis*.

Trypanblue and arrhenal appear to have no effect upon the disease.

Haemoglobinuria does not occur and a subacute attack lasts from four days to a week. Sometimes a period of fever is interrupted by a day or two of normal temperature.

At the post-mortem examination small crater-like and linear ulcerations are found in the abomasum. There may be some enteritis. The spleen is normal in size, but shows ecchymoses, as do the liver and kidneys. The lymphatic glands are enlarged and show haemorrhagic spots.

Examination of the blood shows intracorpuscular rings not exceeding 1μ in diameter, which have a speck of chromatin in the periphery. Only one or two are found per field and not more than one in a single corpuscle. Minute oval and rod-shaped forms also occur.

In the haemorrhagic spots in the spleen and other organs, and in the ulcers in the abomasum, plasmospheres indistinguishable from Koch's bodies may be found.

The acute form is rarely met with. It may develop from the other forms or be acute from the onset. In these cases two or three days after the initial rise of temperature there is lachrymation with petechiae and discoloration (icteric) of the conjunctiva, and salivation. The superficial glands are markedly enlarged. Constipation is followed by diarrhoea, which is blood-stained. The urine may remain normal, but haemoglobin may be detected in it. Blood examination is often necessary to distinguish the condition from Texas fever.

On post-mortem examination the ulcers in the abomasum are never as numerous as in East Coast fever. The caecum and colon show patches of diffuse ulceration. The spleen is enlarged and shows minute haemorrhagic infarcts. These are also seen in the liver. The kidneys show pin-point haemorrhagic infarcts, which are quite different from the large white infarcts seen in East Coast fever. The blood invasion is very heavy. Eighty to ninety per cent. of the corpuscles are invaded by four or five parasites. Rod forms greatly predominate. Plasmospheres are present in the glands and infarcts. Evidences of anaemia have not been observed in the blood.

The disease is therefore due to a Theileria and not a piroplasm, and there is evidence to support the view that it is non-inoculable. Up to the present, crucial inoculation experiments with known "clean" animals have not been carried out, but the evidence derived from large numbers of inoculations with rinderpest blood containing the parasite lends some support to that view.

The disease is not limited to Egypt, as the author has observed it in freshly imported Cyprus cattle, in Sudanese cattle, and in cattle in Palestine.

It appears to be probable that the disease is in reality identical with so-called Transcaucasian fever, and that as a similar disease has been detected in nearly all countries round the Mediterranean some more suitable name than Egyptian or Transcaucasian fever should be found for it. The author records the occurrence of the parasite and of the disease in buffaloes.

Piroplasmosis in Buffaloes.—Buffaloes have been observed to show the clinical symptoms of piroplasmosis, including haemoglobinuria, and their blood has been found to show the changes usually associated with blood destruction, but as yet the parasite has not been found.

It has been noted that buffaloes enjoy a remarkable freedom from ticks as compared with cattle.

LAVIER (G.) & FOURBEURE (G.). **Complications oculaires dans la Piroplasmose canine experimentale.** [Lesions of the Eyes in Experimental Canine Piroplasmosis.]—*Bull. Soc. Path. Exot.* 1922. July. Vol. 15. No. 7. pp. 545–548.

The authors comment upon the absence of any reference to lesions of the eye in the publications of NOCARD and MOTAIS and NUTTALL and GRAHAM-SMITH, and refer to the work of CLARK and BRUMPT showing that in bovine and canine piroplasmosis respectively multiplication of the parasites takes place in the capillaries of the brain. Noting this special predilection for nerve tissues the authors examined sections of the entire eye from a dog dead of acute piroplasmosis, the blood of which contained only a small number of the parasites. The capillaries of the retina and the ciliary processes were found to be packed with piroplasms. The vessels of the choroid, on the other hand, contained only a few.

The authors describe two cases of chronic piroplasmosis in which lesions were observed which involved the eyes.

In one case the aqueous humour of one eye became turbid about two months after inoculation (parasites having appeared in the blood on the fourth day after inoculation) ; while the conjunctiva remained normal. Only the left eye was involved. A fortnight later the dog was killed, and though the cornea was saturated and thickened with clear exudate and there was a mass of fibrinous lymph in the anterior chamber, no invaded corpuscles were found in the capillaries.

In the second case interstitial keratitis developed a month after inoculation in one eye. Subsequently slight conjunctivitis was observed in the other eye, but the dog recovered and the ocular lesions cleared up completely.

The authors draw attention to the resemblance presented by these lesions to those observed in trypanosomiasis, leishmaniasis and toxoplasmosis.

BRUMPT (E.) & LARROUSSE (F.). **Transmission de la Piroplasmose canine française par le** *Dermacentor venustus.* [The Transmission of Canine Piroplasmosis in France by *Dermacentor venustus.*]—*Bull. Soc. Path. Exot.* 1922. July. Vol. 15. No. 7. pp. 540–545.

In view of the very wide distribution of canine piroplasmosis, and of its transmission in natural conditions by means of at least three different species of ticks, the authors have carried out experiments to furnish information as to whether *Dermacentor venustus* is capable of acting as transmitting agent.

The ticks used were obtained from Bitter Root Valley. It is known that dogs act as host to this tick in certain parts of the United States and Canada. By feeding the ticks upon guinea-pigs and hedgehogs a new generation of adult ticks was obtained. Had some young dogs been available a control experiment to prove that the ticks were "clean" would have been carried out first. It was thought, however, that this control could be omitted, as canine piroplasmosis is not known to occur in the United States (with the possible exception of Florida), and in any case they would have been cleaned during their periods of engorgement upon insusceptible animals.

The first experiment had for its object the infection of *Dermacentor reticulatus* with *Piroplasma canis*.

A young dog was placed in a sack with a number of the ticks in March, 1922, but as the tick is a summer tick in the adult phase only a few attached themselves. Five days later the dog was infected by intraperitoneal inoculation. Parasites made their appearance four days later. Within the next few days four engorged females dropped off. From these a new generation was raised by July, and with these infection experiments were carried out.

About 60 of them were placed on a dog, but only two females were observed to attach themselves. One of these was fertilized and dropped off engorged (13 days) and the other dropped two days later but was not fertilized.

Examination of the dog's blood on the 13th day (when the temperature rose suddenly) showed that ring-shaped parasites were present in small numbers. Death took place three days later. On the day prior to death piroplasms were abundantly present, and corpuscles containing as many as eight individuals were found.

Another dog was inoculated intraperitoneally from the above on the day parasites appeared in the blood. Two days later parasites were present in its blood. The following day 0·5 cg. of "Bayer 205" was injected subcutaneously. The next day the dog was worse and the treatment with "Bayer 205" was repeated, this time intraperitoneally. Death took place shortly afterwards. Parasites were present in 4–5 corpuscles per field.

The lesions of anaemia, though present, were not so marked as in the case of the dog infected by the ticks.

CONSEIL (E.) & GÉRARD (F.). **Essais de traitement du Paludisme par le "Trepol."** [The Treatment of Malaria with Trepol.]—*Bull. Soc. Path. Exot.* 1922. July. Vol. 15. No. 7. pp. 534–537.

The authors have tested Trepol (potassium tartaro-bismuthate) in about a dozen cases of malaria, but have found it to be inferior to quinine.

LEGER (M.). **Plasmodium d'un Singe de la Guinée Française,** *Cercopithecus campbelli,* **Wath.** [Plasmodium of a Monkey, *Cercopithecus campbelli,* in French Guinea.]—*Compt. Rend. Soc. Biol.* 1922. Apr. 29. Vol. 86. No. 15. pp. 837–840. With 1 text fig.

Gametes and schizonts of a plasmodium were found in the blood of a recently killed monkey of the above species. The sexual forms predominated, and of these the female elements outnumbered the male by four to one. The majority were free in the plasma.

The parasite appears to differ from *Pl. kochi* in the following points. The young parasite is elongated and has solid-looking cytoplasm. The schizont is not amoeboid and is pigmented. The macrogamete causes enlargement of the invaded corpuscle before it escapes, the pigment granules are coarse and packed together. The nucleus is compact and stains deeply. The name *Plasmodium bouilliezi* is suggested.

ROUBAUD (E.) & FRANCHINI (G.). **Infection Naturelle de la Souris par les Flagellés de la Puce,** *Ctenopsylla musculi* **Dug.** [Natural Infection of the Mouse by Flagellates of the Flea, *Ctenopsylla musculi* Dug.]—*Bull. Soc. Path. Exot.* 1922. June. Vol. 15. No. 6. pp. 405–406.

In five instances mice placed in receptacles for the breeding of mouse fleas became infected with the parasite and died, and in one instance a sub-inoculation to another mouse caused infection. Enlargement of the spleen and ascites were the principal lesions. Parasites were discovered usually in the spleen, liver, lungs and bone marrow, and occasionally in the blood.

The organisms were leishmaniform structures. The blepharoplast was rarely visible. In no case were flagellate forms found.

ROUBAUD (E.) & FRANCHINI (G.). **Infection leishmaniforme produite chez la Souris par l'inoculation des fèces de la Puce,** *Ctenopsylla musculi.* [Leishmaniform Infection produced in the Mouse by Inoculation with the Faeces of the Flea, *Ctenopsylla musculi.*]—*Bull. Soc. Path. Exot.* 1922. June. Vol. 15. No. 6. p. 407.

The dried faeces of fleas, which are alleged to contain resistant forms of the flea parasite were used with success to inoculate a mouse. Leishmaniform parasites were scantily present in the blood from the 15th day, and when the mouse was killed after two months parasites were present in the spleen, liver, lungs, kidneys, bone marrow and blood. No flagellate forms were found.

A culture in N.N.N. medium failed to show any flagellate forms.

FRANCHINI (G.). **Particularités de culture de certains flagellés. De la culture des Leishmania dans le Milieu de Yoshida.** [Details regarding Cultures of Certain Flagellates. The Cultivation of Leishmania in Yoshida's Medium.]—*Bull. Soc. Path. Exot.* 1922. July. Vol. 15. No. 7. pp. 551–555. With 2 text figs.

In cultures of *Pyrrhocoris apterus* the author has observed what appears to be amoeboid movement of the organisms. The observations were made on blood-broth cultures several months old. The same parasite on N.N.N. medium gave no evidence of this.

In certain conditions it was found that *H. pyrrhocoridis* could resist desiccation. It was found that a few drops of culture which had been left in the bottom of a tube and which had become quite dry gave positive results on resowing.

In very old cultures forms having the appearance of cysts have been found.

The author has been able to cultivate the Leishmania of kala azar in Yoshida's medium, and in general the morphology of the parasites resembles those cultivated on N.N.N. medium, but very large rounded parasites with a number of nuclei and centrosomes, such as are not found in N.N.N. cultures, have been encountered.

CAUCHEMEZ (L.). **Présence d'amibes non iodophiles chez les Porcs français.** [The Presence of Non-iodophile Amoebae in French Pigs.]—*Bull. Soc. Path. Exot.* 1922. June. Vol. 15. No. 6. pp. 390–393. With 1 text fig.

During the year 1921 the author examined at least 300 samples of faeces of pigs, and, in addition to the iodophile amoeba already recorded, encountered non-iodophile parasites on three occasions. In preparations fixed in Bouin's liquid and stained with haematoxylin the parasites present, as a rule, a rounded appearance and measure from 5 to 12 μ in diameter. The protoplasm is vacuolated and the ectoplasm slightly granular. The nucleus is very pale, measures 2–2·5 μ, and shows a small karyosome in its centre. Binuclear forms, which probably represent the first stage of division, have been encountered. Similar parasites have been described by Smith, Prowazek, Hartmann and Nöller.

A search was made in various parts of the intestine of an infected pig with a view to determining the distribution of the parasites. They were found in the posterior part of the colon and rectum only.

Sections of the rectum failed to show any lesions or penetration of the parasites.

Rodhain (J.). **L'Ubiquisime parasitaire de l'*Ornithodorus moubata* peut-il influer sur son infection par le spirochète de Dutton ?** [Does the Capacity of *O. moubata* to engorge on Various Animals influence its Transmission of *S. duttoni* ?]—*Bull. Soc. Path. Exot.* 1922. July. Vol. 15. No. 7. pp. 564–565.

As the result of a small number of experiments the author comes to the conclusion that at least as far as the chameleon is concerned the transmission is not inhibited, but states that further experiments are necessary.

Anigstein (L.). **Serological Researches on Protozoa. I. Morphology and Serological Properties of *Prowazekia* (*Bodo*) *edax*.**—*Jl. Trop. Med. & Hyg.* 1922. Aug. 1. Vol. 15. No. 25. pp. 242–246.

Carpano (M.). **La transmissione placentare della piroplasmosi.** [Transmission of Piroplasms via the Placenta.]—*Ann. d'Igiene.* 1922. Apr. Vol. 32. No. 4. pp. 286–292. With 2 text figs.

Creech (G. T.). **Sarcosporidiosis of Swine, associated with advanced Degenerative Changes in the Musculature.**—*Jl. Amer. Vet. Med. Assoc.* 1922. July. Vol. 61. No. 4. pp. 383–392. With 4 figs.

Cross (H. E.). **Spirochaetosis of Fowls.**—*Dept. of Agric., Punjab Vet. Bull.* No. 2 of 1921. pp. 1–5. With 1 plate.

Fourcade (M.), Jaloustre (L.) & Lemay (P.). **Sur les propriétés spirillicides de l'oxyde hydraté de bismuth.** [The Spirillicidal Properties of the Hydrated Oxide of Bismuth.]—*Compt. Rend. Soc. Biol.* 1922. Apr. 24. Vol. 86 No. 15. pp. 815–817.

Hadwen (S.). **Cyst-forming Protozoa in Reindeer and Caribou, and a Sarcosporidian Parasite of the Seal** (*Phoca richardi*).—*Jl. Amer. Vet. Med. Assoc.* 1922. July. Vol. 61. No. 4. pp. 374–382. With 8 figs.

van Nederveen (H. J.). **Over de al- of niet identiteit van het Runder- en het Konijneucoccidium.** [Regarding the identity or otherwise of the Coccidia of Cattle and Rabbits.]—*Tijdschr. v. Vergelijkeude Geneesk. enz.* 1922. Aug. 6. Vol. 7. No. 4. pp. 226–233. [French and English Summaries, pp. 233–235.]

Nieschulz (Otto). **Beiträge zur Kenntniss der Gattung Eimeria. I. Über das Taubencoccid.** [The Genus Eimeria. I. The Coccidium of the Pigeon.]—*Arch. f. Protest.* 1921. Dec. 21. Vol. 44. No. 1. pp. 71–82. With 4 plates and 3 text figs.

NIESCHULZ (Otto). **Ueber die Benennung des Schweinecoccids.** [The Nomenclature of the Coccidium of the Pig.]—*Cent. f. Bakt.* 1. Abt. Orig. 1922. June 30. Vol. 88. No. 5. pp. 379–380.

PARROT (L.) & DONATIEN (A.). **Un nouveau cas sporadique de bouton d'Orient sur le littoral algérien.** [A New Sporadic Case of Oriental Sore on the Algerian Coast.]—*Bull. Soc. Path. Exot.* 1922. June. Vol. 15. No. 6. pp. 410–412.

SINTON (J. A.). **A Simplified Method for the Cultivation of** *Plasmodium falciparum* **in Vitro.**—*Indian Jl. Med. Res.* 1922. July. Vol. 10. No. 1. pp. 203–209.

SINTON (J. A.). **Further Remarks on a Clinical Method for the Cultivation of the Subtertian Malaria Parasite in Vitro, with a Note on its Use in Diagnosis.** —*Indian Jl. Med. Res.* 1922. July. Vol. 10. No. 1. pp. 210–214.

DISEASES DUE TO METAZOAN PARASITES.

BRUCE (E. A.). **Fatalities in Cattle due to the Tick** *Dermacentor venustus.*—*Jl. Amer. Vet. Med. Assoc.* 1922. Aug. Vol. 61. No. 5. pp. 537–539.

The tick has a wide distribution in south-eastern British Columbia, and in the spring is a frequent cause of paralysis and sometimes of death in man and animals. The condition is very commonly observed among sheep, and somewhat rarely in dogs.

D. venustus is, with the exception of *D. albipictus*, the commonest cattle tick in the area, but up to the present no records of ill effects in cattle have been published.

Before dealing with two cases in cattle the author outlines the state of affairs in a flock of 400 sheep, 300 of which he saw affected, in the spring of 1920.

The first case occurred on the eighth day after the sheep were turned out on the range, and three days later practically the whole 300 (out of 400) were affected. Improvement began to appear in some animals three days later, and after a week the sheep were moved from the hills to meadowland. Within a few days only a few animals showing inco-ordination and one paralysed remained. Ten females were found on this yearling. These were removed and prompt improvement was observed.

Cases in Cattle. Some affected cattle were imported from Alberta the previous autumn, and the symptoms are said to have been similar to those presented by sheep.

The first case was a two-year-old heifer in poor condition, which was found dead, and from the condition of the carcase and of the ground it was judged that death had occurred two days previously, and that the animal had been down and struggling for possibly 24 hours before death occurred. An area of about an inch across was found just behind the base of the horns, which was covered with the excrement of ticks, and there were four other places along the spine which gave evidence that ticks had been attached.

The second case was also a two-year-old heifer. This was still alive when seen, but it appeared to have been down for about 12 hours. On the back of this animal there was an area, three inches in diameter, which was covered with ticks, mainly engorged females (about 100). There was a smaller area behind the base of the horns and other places with ticks attached.

RODHAIN (J.). **La subsistance de l'*Ornithodorus moubata* sur des reptiles et des sauriens.** [The Subsistence of *Ornithodorus moubata* on Reptiles and Lizards.]—*Bull. Soc. Path. Exot.* 1922. July. Vol. 15. No. 7. pp. 560–564.

The author has previously recorded the fact that *O. moubata*, the transmitting agent of relapsing fever in Central Africa, can maintain itself on animals of variable temperature.

The author has not been able to complete the experiments he had in mind, but certain results have been obtained.

He found that the blood of the lizard, gecko and snake are as suitable for the nymphs as guinea-pig blood, but that the blood of the chameleon is difficult to digest, and toxic. It produces a lethargic condition in the ticks, and large numbers die after a full meal of it.

Nymphs which had three meals on *Causus rhombeatus* were at 5½ months as large as those fed upon guinea-pigs and rats; larvae fed on the snake died in larger numbers than those fed on the mammals.

Subsequent experiments indicated that survival of a meal of chameleon blood enabled the ticks to feed upon them subsequently without ill effect, but the blood was always difficult of digestion. The ticks may become mature, but it is not established whether they can lay viable eggs.

ROUBAUD (E.) & DESCAZEAUX (J.). **Evolution de l'*Habronema muscae* Carter chez la mouche domestique et de l'*H. microstomum* Schneider chez le Stomoxe.** [The Development of *Habronema muscae* Carter in the House-Fly and of *H. microstomum* in Stomoxys.]—*Bull. Soc. Path. Exot.* 1922. July. Vol. 15. No. 7. pp. 572–574.

The authors refer to their previous investigations regarding the development of *H. megastomum* in the Malpighian tubes of the larva of the house-fly, and are able to state, as a result of more recent research, that it is in the distal portion of the posterior pair of tubes that this development takes place.

The authors find that the developmental processes of *H. muscae* and *H. microstomum* are identical, and are as follows:—

The embryos ingested by the flies pass through the wall of the alimentary tube and for a short time are free in the body-cavity. They then penetrate the fat body, and remain there until they have reached the third stage of development. In no instance is there any encystment. The encystment described by other observers is apparently the wall of the adipose cell enclosing the parasite.

The escape of the larvae from the proboscis is one of active spontaneous emission depending upon a definite degree of warmth and moisture. Horses become infected either via mucous membranes or wounds.

JOHNSTON (T. H.) & BANCROFT (M. J.). **The Life-History of Habronema in Relation to *Musca domestica* and Native Flies in Queensland.**—*Proc. Roy. Soc. Queensland.* Brisbane. 1920. June 1. Vol. 32. No. 5. pp. 61–88. With 7 text figs. (Summarized in *Rev. App. Entomol.* 1922. Jan. Vol. 10. Series B. Pt. 1. p. 15.)

In Australia *H. muscae* and *H. megastoma* are transmitted by *M. domestica, M. humilis, M. lusoria, M. terrae-reginae, M. hilli, Pseudopyrellia, Sarcophaga misera,* and probably other species of Sarcophaga. *Anastellorhina augur* has been infected experimentally with Habronema, but it does not appear to transmit the parasite normally The larval development of *H. microstoma* occurs in *Stomoxys calcitrans*, and *Lyperosia exigua* is also suggested as a possible host.

Patton (W. S.). **Note on the Value of a Tame Cow for Collecting Blood-Sucking Diptera of a Locality.**—*Indian Jl. Med. Research.* 1922. July. Vol. 10. No. 1. pp. 66–68.

The author has found a tame cow an extremely valuable assistant in collecting biting insects, but he insists that it must be really quiet and must not object to nets or test-tubes being placed on its skin. He gives a list of 24 Diptera collected upon a tame bull at Coonoor

Cross (H. E.) & Patel (P. G.). **Hypoderma Larvae in Goats.**—*Dept. of Agric. Punjab Vet. Bull. No. 3.* 1921. pp. 1–3. With 1 plate.

In the Jhelum District, in October and November, 1920, an examination revealed the existence of infested goats in percentages ranging from 48 to 91 in different herds. The number of parasites found varied between 6 and 30 per animal. It has been calculated that 25 per cent. of goat skins exported from India are depreciated from 50 to 70 per cent. as a result of damage done by the parasites.

Larvae emerge during December and flies emerge from the pupae during February and March.

The larvae have 11 segments, of which the first five have two circlets of minute black bristles. Preserved fully grown larvae measure about 17 mm. by 10 mm. There is a row of irregular protuberances on each segment, those at the sides being the larger, and each carries some yellowish scale-like growth. The ventral surface is set with chitinous ridges, one between two segmentations, and is provided with a row of minute denticles. These ridges are absent from the last three segments.

Hirst (S.). **Mites Injurious to Domestic Animals (with an Appendix on the Acarine Disease of Hive Bees).**—*British Museum (Natural History) Economic Series, No. 13.* pp. 1–107. With 85 text figs. London: Printed by order of the Trustees of the British Museum. 1922. [Price 3*s.*]

The principal value of this publication lies in the clear illustrations of the various parasites dealt with.

Gigliolí (G.). ***Armillifer brumpti* n. sp., nouvelle espèce de Linguatulidé de Madagascar.** [*Armillifer brumpti* n. sp., a New Species of Linguatula from Madagascar.]—*Bull. Soc. Path. Exot.* 1922. July. Vol. 15. No. 7. pp. 565–572. With 2 text figs.

The author gives a detailed description and classification of a linguatula found in a snake (species and genus not known) in Madagascar.

Tubangui (M. A.). **Two New Intestinal Trematodes from the Dog in China.**—*Proc. U.S. National Museum.* 1922. Vol. 60. Art. 20. pp. 1–2. With 4 plates.

The author describes two worms in the United States National Museum which have not hitherto been dealt with. They are a species of Prohemistomum and a variety of *Echinochasmus perfoliatus*, which differs from the European specimens.

MAPLESTONE (P. A.). *Cryptocotyle lingua* **(Creplin, 1825), Fischoeder, 1903, in a Dog in England.**—*Ann. Trop. Med. & Parasit.* 1922. July 20. Vol. 16. No. 2. pp. 153–156. With 1 text fig.

Three specimens of this fluke were found in a dog killed in Liverpool. The worm has previously been recorded from many fish-eating birds in Europe and North America, and once in a dog (WIGDOR, 1918).

From his examination of the specimens found, the author is inclined to think that RANSOM's definition of the genus (1920) is too detailed for generic distinction.

CAWSTON (F. G.). **Bilharzia in Cattle. A Question of Identity; Promising Curative Measures.**—*The Farmer's Weekly.* Bloemfontein. 1922. Apr. 26. Vol. 23. No. 581. p. 620.

Bilharzia has not up to the present been recorded as a naturally occurring parasite of cattle, but the author has found ova resembling those of cattle bilharzia in the urine of three boys who had frequently entered water used by cattle. The identity of the parasites can only be determined with certainty from an examination of adult worms, and efforts are being made to obtain these from the eggs passed.

The question arises whether the bilharzia parasite of man, which is so common in some parts of Natal, may not sometimes infest cattle, and the suggestion is put forward that some chronic cases of redwater, in which the animals remain in fairly good condition, may be due to such an infestation.

The possibility of good results following the administration of freshly prepared solutions of tartar emetic is suggested.

CAWSTON (F. G.). **The Experimental Infestation of** *Physopsis africana.* —*Ann. Trop. Med. & Parasit.* 1922. July. Vol. 16. No. 2. pp. 207–211. With 3 text figs.

The interest of this short paper lies in the description of the technique employed.

The author found that glass jars were unsuitable for observing growth for more than a few days, but that wooden tubs kept in the shade out of doors answered very well. There was no need to change the water, and an abundance of food was present in the form of water plants, leaves, etc. Specimens large enough for experimental purposes could only be obtained after about five months.

CURTICE (Cooper). **The Protection of Lambs from Stomach Worms.**—*Jl. Amer. Vet. Med. Assoc.* 1922. Aug. Vol. 61. No. 5. pp. 529–533.

It is recommended that all sheep on the farm should be given copper sulphate solution once every four weeks throughout the year, excluding unweaned lambs and ewes within a fortnight of lambing.

The copper sulphate solution is made up by dissolving one pound of the salt to two quarts of water. This is a stock solution. For use four ounces of this are added to three quarts of water, and this is sufficient for 25 sheep. More accurately, the dose must be varied in accordance with weight; four ounces for an 80-lb. sheep, three ounces for a 60-lb. one, and so on in proportion.

Supplementary control measures are necessary to secure the best results. Frequent changes of pasture (to clean or slightly contaminated ones). Cultivation reduces the soil infestation, and the keeping of land free from cattle or sheep for at least a year is valuable.

The treatment and measures of sanitary control advised have proved valuable not only from the point of view of checking the malady, but in the increased value of the flocks, fleeces, etc., etc.

JOHNSTON (T. H.). **Onchocerciasis of Queensland Cattle.**—*Trans. Proc. Roy. Soc. South Australia.* Adelaide. 1921. Dec. 21. Vol. 45. pp. 231–247. With 28 figs & 1 table. [Summarized in *Rev. App. Entomol.* 1922. July. Vol. 10. Series B. Part 7. p. 133.]

The three species of *Onchocerca*, Neum., recorded are: *O. gutturosa, O. lienalis*, Stiles, and *O. gibsoni*, Cleland & Johnston. The above are found in cattle in Queensland, New South Wales and the Northern Territory.

Reference is also made to *O. fasciata*, Railliet & Henry, of camels in Western Australia.

SWIFT (H. F.), BOOTS (R. H.) & MILLER (C. P.). **A Cutaneous Nematode Infection in Monkeys.**—*Jl. Experim. Med.* 1922. May 1. Vol. 35. No. 5. pp. 599–620. With 14 plates.

The authors describe a naturally occurring infection in monkeys caused by a worm parasite. Full details of the distribution and nature of the lesions are given.

Only a few intact specimens of the female worm were obtained. Its classification is discussed and the decision is arrived at that it belongs to the genus *Capillaria* (synonym *Trichosoma*), and the specific name *Trichosoma cut neum* 1922 is suggested.

A number of monkeys (*Macacus rhesus*) were found to be infested, and the lesions varied in location and type. Subcutaneous nodules, oedema around joints, elongated blisters on the palms and soles were observed.

In the subcutaneous nodules larval and possibly male forms were found. Eosinophiles, giant cells and young blood-vessels were found in these lesions, with, subsequently, encapsulation and, after the death of the worm, disappearance of the nodules. In the skin of the palms and the soles elongated blood blisters were formed by the burrowing female. In these the eggs were laid. With subsequent formation of pus and rupture of the blisters the eggs were liberated.

MAPLESTONE (P. A.) & SOUTHWELL (T.). **Notes on Australian Cestodes. V. Three Cestodes from the Black Swan.**—*Ann. Trop. Med. & Parasit.* 1922. July. Vol. 16. No. 2. pp. 189–198. With 7 text figs.

The parasites described in this paper are :—

1. *Nematoparataenia paradoxa* n.g., n.sp.;
2. *Echinorhynchotaenia nana* n.sp.;
3. *Hymenolepsis lanceolata* (Bloch, 1782), Weinland 1858:

and all were obtained from the black swan (*Chenopsis atrata*).

SOUTHWELL (T.). **Cestodes in the Collection of the Indian Museum.**—*Ann. Trop. Med. & Parasit.* 1922. July 20. Vol. 16. No. 2. pp. 127–152.

This paper is divided into six sections. The first is a catalogue of Cestodes found for the most part in mammals dying at the Calcutta Zoological Gardens. The second part deals with the tapeworms of pigeons, the others with those of ducks, crows, miscellaneous birds, reptiles and amphibians.

Vajda (T.). **A New Method for Detecting the Eggs of Parasites in Faeces.**—*Jl. Amer. Vet. Med. Assoc.* 1922. Aug. Vol. 14. No. 5. pp. 534–536. With 1 text fig.

This method depends upon making a mixture of the faeces with a specific gravity greater than that of the eggs. Glycerin is used for this purpose. Horse or pig faeces should be thoroughly mixed with twice their volume of water; for sheep, goat or dog faeces three times the amount. For soft faeces the amount of water should be reduced, and in cases of diarrhoea no water should be added. As the eggs of different species vary in specific gravity the minimum amount of glycerin necessary for their isolation varies. For Strongylus, Oxyuris, Dochmius and Oesophagostomum an equal amount of glycerin is used. For *Ascaris megalocephala* 1½ volumes are used, and for *A. marginata*, *A. lumbricoides* and Trichuris 3 parts are used.

The mixture is centrifuged at moderate speed for 15–20 minutes, and the eggs rise to the top of the liquid. For microscopic examination they may be removed by touching the surface of the liquid with a dry glass rod and transferring the eggs adhering to it to a slide. The rod should not be dipped into the liquid and a pipette should not be used, as by these means fewer eggs are recovered.

Eggs remain unchanged in the top layer of liquid for a long time, and a certain degree of development of the embryos may occur. If examinations of the specimens cannot be made on the spot, a useful method of collecting the material is to tie a piece of filter paper over the top of a wide tube and lower this down until it touches the surface of the liquid. This will carry the eggs away with it, and may be kept after careful drying for subsequent examination.

Fluke eggs cannot be examined in this way, as the glycerin is destructive to them.

Cuirea (I.). **Sur quelques trématodes du renard et du chat sauvage.** [Some Trematodes of the Fox and Wild Cat.]—*C.R. Soc. Biol.* 1922. June 24. Vol. 87. No. 23. pp. 268–269.

Crawley (H.). **A Case of Demodectic Mange in a Bull.**—*Jl. Amer. Vet. Med. Assoc.* 1922. July. Vol. 61. No. 4. pp. 441–443. With 1 fig.

Daubney (R.). **The Lesions in Lungworm Disease [" Husk " or " Hoose "] of Cattle.**—*Jl. Comp. Path. & Therap.* 1922. June 30. Vol. 35. No. 2. pp. 108–117. With 6 text figs.

Delanoë (P.). **Le Mouton piège à puces.** [Sheep as Flea Traps.]—*Bull. Soc. Path. Exot.* 1922. June. Vol. 15. No. 6. pp. 417–418.

Delanoë (P.). **Au sujet d'***Ornithodorus marocanus* **Velu 1919.** [*Ornithodorus marocanus* Velu 1919.]—*Bull. Soc. Path. Exot.* 1922. June. Vol. 15. No. 6. pp. 418–420.

Gedoelst (L.). **La trimorphisme larvaire des Oestrides.** [The Trimorphism of the Larvae of Oestridae.]—*Compt. Rend. Soc. Biol.* 1922. Mar. 4. Vol. 86. No. 9. pp. 501–504.

Hall (M. C.). **The Eggs and Larvae of Poultry Parasites.**—*Veterinary Medicine.* 1922. Sept. Vol. 17. No. 9. pp. 535–538.

Johnston (T. H.) & Tiegs (O. W.). **On the Biology and Economic Significance of the Chalcid Parasites of Australian Sheep Maggot Flies.**—*Proc. R. Soc. Queensland.* Brisbane. 1921. Aug. 17. Vol. 33. No. 6. pp. 99–128. With 36 figs.

Khalil (M.). **A Preliminary Note on some new Nematode Parasites from the Elephant.**—*Ann. and Mag. Nat. Hist.* 1922. Feb. Vol. 9. Series 9. pp. 212–216.

Leger (M.). **Microfilaire sanguicole nouvelle du** *Cercopithecus butukoferi.* [A New Blood Filaria of *Cercopithecus butukoferi.*]—*Compt. Rend. Soc. Biol.* 1922. Apr. 29. Vol. 86. No. 15. pp. 835–837. With 1 fig.

NOC (F.). **Infestation massive naturelle de la Genette du Sénégal par des larves de Porocéphales.** [Heavy Natural Infestation of the Genet (*Genetta pardina*) in Senegal with Porocephalus Larvae.]—*Bull. Soc. Path. Exot.* 1922. July. Vol. 15. No. 7. pp. 621–631. With 3 plates.

NOC (F.) & GIGLIOLI (G. S.). **Linguatulids parasitic in Monitors. The New Genus Sambonia.**—*Jl. Trop. Med. & Hyg.* 1922. Sept. 1. Vol. 25. No. 17. pp. 276–280. With 4 text figs.

PILLERS (A. W. N.). *Paramphistomum cervi* **(Zeder) from a Cow in Cheshire.**—*Vet. Jl.* 1922. Aug. Vol. 78. No. 8. pp. 292–293. With 1 text fig.

SHANNON (R. C.). **The Bot-flies of Domestic Animals.**—*Cornell Veterinarian.* 1922. July. Vol. 12. No. 3. pp. 240–262. With 11 text figs.

BACTERIAL DISEASES.

SCHROEDER (E. C.). **The Present Status of Vaccinations against Abortion Disease of Cattle.**—*Jl. Amer. Vet. Med. Assoc.* 1922. July. Vol. 61. No. 4. pp. 363–373.

In his opening paragraphs the author refers to two statements previously made by him regarding the value of live cultures of the abortion bacillus in certain circumstances, and he sees no reason to modify those statements. He also draws attention to the unsatisfactory and often very disappointing results that follow the use of vaccines of doubtful nature. The three points dealt with in the present paper are: (1) the peculiar nature of the problem of immunizing against abortion; (2) the factors which must be taken into consideration before vaccination is approved; (3) the results of tests carried out with samples of suspensions of alleged live abortion bacilli purchased in the open market.

1. The problem is peculiar in that the true habitat of the organism is the foetal membrane, an organ which is intermittently present. When this organ is absent the animals are virtually immune, but not because of the absence of foetal envelopes, since the organism does not seem to have power to attack or flourish in the other organs. It may, however, persist for varying periods in the udder, but it has not been proved to be responsible for disturbances.

It will therefore be seen that the aim of the injections is to establish an immunity for the protection of an organ which is to be developed later. Hence it is important to time the injections carefully. It may be inferred from the frequent occurrence and often long persistence of abortion bacilli in the udders of infected and apparently immune cows that antibodies rarely become excessively abundant. This factor indicates that it is reasonable to think that large or repeated doses are required to establish immunity, and explains the superiority of living over dead or attenuated cultures. The problem is complicated by the fact that animals injected with living virulent vaccine may become persistent and dangerous carriers of infection.

2. Factors requiring consideration.

The strains that may be used safely for vaccine preparation.

In conjunction with COTTON, the author recently had the opportunity of examining three strains of abortion bacilli isolated from swine in Indiana, Illinois and California. The three were alike in all their characters, which were those of Bang's bacillus. In their pathogenicity for guinea-pigs they were not wholly like any of the strains isolated from infected cattle. The lesions produced were more gross in character, lesions of the bones were more common, and lesions developed in parts of the body in which bovine strains have not been observed to cause lesions. An example of the latter was the development of post-orbital abscesses, causing destruction of the eyeball. One of the strains was proved to be capable of producing abortion in both cattle and swine. This is important, as swine are usually resistant to strains of bovine origin.

The evidence appears to indicate that the type of bacillus which is pathogenic for both swine and cattle is more pathogenic for the guinea-pig than organisms isolated from outbreaks among bovines only.

The question of virulence must therefore be considered in making living suspensions for protective purposes.

Experiments made by the author and Cotton some years ago have been repeated with the same results, namely, that suspensions of abortion bacilli in normal salt solution rapidly lose virulence, so that they may fail to produce lesions in guinea-pigs after 48 hours. The loss of virulence was associated with loss of viability on culture media. These results were obtained with five strains. The reason for this is not as yet known, and sufficient tests have not been carried out to determine whether it is a frequently occurring phenomenon or not. This point is of importance in connexion with the marketing of so-called living vaccines.

The conditions under which bacteria for suspensions are grown also require consideration. Experiments have indicated that bacilli grown in vessels, the air in which is rich in carbonic acid gas, are not as readily or as perfectly agglutinated as those grown in ordinary air. Nothing is known regarding the factor or factors responsible for this. The possibility of the bacillus being influenced by the type of container in which the suspension is dispensed must also be a point for further investigation, as it is conceivable that the colour of the glass used might influence so delicate an organism as the *B. abortus*.

In the meantime, and until fuller information is obtained, the author is inclined to think that in order to immunize cattle successfully it may be necessary to send the living undisturbed cultures to the place where the vaccine is required, so that the suspensions may be made on the spot and used within a few hours.

3. In examining commercially-produced vaccines the following tests were applied to each of 24 samples obtained : (1) microscopic examination of the vaccine itself ; (2) cultivation on suitable media ; (3) microscopic examination of cultures obtained ; and (4) tests with positive and negative sera by agglutination.

The following tables record the results :—

1. *Microscopic Examination of the Suspensions.*

Bacteria indistinguishable from abortion bacilli	15
Slightly contaminated	2
Grossly contaminated	7

2. *Growth on Culture Media.*

Abundant growth indistinguishable from growth of *B. abortus*	14
Very meagre growth, but indistinguishable from *B. abortus*	3
No growth	1
Growth quite unlike that of *B. abortus*	3
Cultures not made on account of obvious contaminations	3

3. *Examination of Growths obtained.*

Bacteria indistinguishable from *B. abortus*	14
Same plus a few large cocci	3
Pure cultures of a large coccus	2
Miscellaneous bacteria	1
No growth	1
Cultures not made	3

4. *Agglutination Tests.*

Completely agglutinated by positive serum and negative to negative	7
Poorly by positive, negative to negative	3
Poorly by positive, more or less sensitive to negative	8
Suspensions containing so-called antiserum could not be tested	6

The condemnation of suspensions by one or other or more of these tests left at the end only five out of 24 which responded correctly to all of them. The samples were obtained from five different concerns, but to dispel any impression that a particular producer's article is invariably excellent the results obtained with six samples obtained from the producer with the best record are tabulated as follows :—

Satisfactory to all four tests	2
Satisfactory to 3 tests, but only a few bacteria viable as shown by cultivation	2
Satisfactory to 3 tests, but practically dead	1
Satisfactory to 2 tests, but dead by cultural test	1

As the suspensions were dated to be used before a date two months after the tests were carried out, there was a possibility that at that date even less satisfactory results would be obtained.

The author's conclusion is that vaccination is in the experimental stage.

FITCH (C. P.). **The Cultivation of the** *Bacterium abortus* **Bang.**—*Jl. Infect. Dis.* 1922. Sept. Vol. 31. No. 3. pp. 233–236. With 1 text fig.

The author has tried the various special methods which have been devised for the cultivation of this organism, and finds that the best results are obtained on slants of beef infusion agar with 10 per cent. of horse serum adjusted to P_H 6·8 to 7·2 incubated in an atmosphere with about 10 per cent. carbon dioxide.

He has found however that, contrary to the view expressed by HUDDLESON, the carbon dioxide has no special action in favouring the growth of the bacillus. Exactly parallel results were obtained when hydrogen was substituted for the carbon dioxide.

MEYER (K. F.), SHAW (E. B.) & FLEISCHNER (E. C.). **The Pathogenicity of** *B. melitensis* **and** *B. abortus* **for Guinea-pigs.**—*Jl. Infect. Dis.* 1922. Aug. Vol. 31. No. 2. pp. 159–197.

In this paper the authors detail further tests which have been carried out with *B. melitensis* and *B. abortus*. As the paper is full of details of technique and of laboratory experiments it does not lend itself to abstraction; the authors' discussion and conclusions may, however, be summarized as follows :—

The authors refer to results already published in which the test animals used were monkeys. In the present series guinea-pigs have been used. It would appear that while for the monkey *B. melitensis* is the more virulent, the reverse is the case in the guinea-pig. Experiments designed to provide an answer to the question whether either organism can be transformed into the other have not yielded positive results.

It is sometimes difficult to distinguish the diseased conditions produced in guinea-pigs by the two organisms save by cross-absorption tests. Four strains of *B. melitensis* from various sources infected guinea-pigs regularly, while 18 proved non- or feebly pathogenic. The lesions were, however, less severe than those caused by *B. abortus*; they had, however, a similar distribution.

MINETT (F. C.). **Immunological Studies with the Preisz-Nocard Bacillus and their Application to Ulcerative Lymphangitis in the Horse.**—*Jl. Comp. Path. & Therap.* 1922. June. Vol. 35. No. 2. pp. 71–107.

It is impossible to do justice to this paper, which abounds in technical details, in a brief abstract, and those interested should consult the original; the following is an abstract of the author's "General Discussion and Conclusions."

The injection of the Preisz-Nocard bacillus into experimental animals produces antitoxin, agglutinins, precipitins, complement-fixing bodies and, less definitely, opsonins.

It has been possible to separate two strains which were different antigenically from the others (eight in number). One of these was from an unusual situation, and the other produced a toxin of a different type from that of the main group. The opportunity was taken of showing that it differed from the toxin of *B. diphtheriae*. The existence of strains of B. Preisz-Nocard showing such differences is on all fours with what is known regarding the toxins of strains of *B. diphtheriae*. The value of the complement-fixing power has not been definitely established, but indications of its value have been obtained. It is important that strains which are powerfully antigenic should be used.

Evidence has been produced in the experiments recorded in this paper and elsewhere to show that the Preisz-Nocard bacillus and *B. diphtheriae* belong to the same group, that they produce similar toxins, and tend to remain latent in the tissues once they are introduced. Carriers of both infections are known to exist. Both organisms possess remarkable powers of vitality under certain conditions. By using heat-killed or alcohol-ether-killed bacilli one can prepare a serum which is both antibacterial and antitoxic. The best technique for the production of antisera has to be worked out. In cases of ulcerative lymphangitis careful local application of an antibacterial serum should be tried. Vaccines have been found to be capable of stimulating the production of antibacterial and antitoxic substances in experimental animals (horses and rabbits), and the concentration of such bodies has been found to be greater after intravenous injection than after subcutaneous. To obtain the best results in treatment the vaccine should be given as early as possible, and in the earlier stages should be accompanied by serum injections. The usual surgical treatments should be carried out.

ABT (G.) & LOISEAU (G.). **Réaction du milieu et production de la toxine diphtérique.** [The Reaction of the Medium and the Production of Diphtheria Toxin.]—*Ann. Inst. Pasteur.* 1922. July. Vol. 36. No. 7. pp. 535–561.

The author finds that Martin's broth with a reaction of P_H 7·5 to 7·9 gives very regular results. The toxin produced in such a medium kills guinea-pigs of 350 gm. in four days at a dose of $\frac{1}{700}$ cc. Similarly, powerful toxin may be obtained in a medium of P_H 6·8, and the cultures are toxic from the seventh to the eleventh day. Above P_H 8·6 no toxin appears to be formed, and below P_H 6·8 the toxicity rapidly declines. Of a toxin developed in a medium of P_H 5·8 to 6·1 about 0·1 cc. is required to kill a guinea-pig.

The explanation is not yet forthcoming as to why, when a medium which is too acid at first subsequently becomes alkaline, no toxin is developed.

The change of reaction in Martin's broth during the first few days of cultivation depends upon whether it is above or below P_H 7·3 to 7·4 to begin with. When it is more acid to begin with it tends to become more alkaline and vice versa.

KNOWLES (R. H.). **Detection of the Spores of the** *Bacillus anthracis* **in Soil.**—*Jl. Comp. Path. & Therap.* 1922. June. Vol. 35. No. 2. pp. 121–125.

In this paper is described an outbreak of anthrax at Baghdad which, in the course of about a month, resulted in the death of 34 horses and 12 mules.

The symptoms were those ordinarily presented, but it is noted that there was moderate swelling of the throat in four cases only, and that in one animal swelling of the sheath was pronounced. Blood from one of the ear veins was taken for examination in each instance.

When microscopic examination failed to establish a diagnosis other methods were employed. The blood proved positive by the microscope in 74 per cent. of cases, and in the remaining cases diagnosis was established by artificial cultivation.

Samples of hay, barley, lucerne and bersim were tested with a view to establishing the source of the infection, and in all 26 samples were examined. Cultural and biological methods were used. All the culture tests failed, but one plot of ground from which lucerne was obtained was incriminated by the biological test. Feeding with the green food was stopped, and the last case occurred ten days after. When feeding with green foods was again started, that from the particular plot incriminated and those immediately round it was excluded. No other cases occurred. This confirmed the source of the contamination.

As the temperature at the time was 90–95° F. and there was plenty of moisture from irrigation, it is possible that the bacillus of anthrax was maintaining itself as a saprophyte; on the other hand, the crowding out of the bacillus by other organisms, which was observed in culture, rather suggested the possibility that the anthrax bacillus would not be able to compete with the more rapidly growing saprophytes.

The area of land from which the contaminated food was obtained was known to have been used for Turkish horse lines.

MASON (F. E.). **Treatment of Tetanus in the Horse by Magnesium Sulphate.**—*Jl. Comp. Path. & Therap.* 1922. Mar. Vol. 35. No. 1. pp. 39–40.

The author refers to an article describing this treatment which appeared in the same journal in 1911 by DAWSON, who described the treatment as "Dr. Paterson's," but gave no reference.

The necessity for a safe, practicable and inexpensive treatment led him to experiment along the same lines.

His first experiments were carried out in 1912, when seven cases were treated. The animals, Arab horses and Syrian mules, were given daily subcutaneous injections of 50 cc. of a 30 per cent. solution. Other medicinal treatment was given, but no serum. Four out of the seven recovered.

Between the years 1912 and 1920 details of 123 cases of tetanus were collected. They included 44 horses, 46 mules, 21 donkeys, 8 cattle and 4 camels. Sixty-one of these did not receive the magnesium sulphate treatment, and the mortality was 80 per cent. Sixty-two were given the medicament, and the mortality was 32·26 per cent.

Four cases which had the drug also had serum, but two recovered and two died.

In seven cases, five horses and two cattle, serum was used upon animals which had not had magnesium sulphate. Four of the horses died. The cattle, which are less susceptible, recovered.

Daily doses of 50 cc. (average) of 30 per cent. solution are given until the symptoms disappear, which usually takes place in a week. A fresh site should be selected for each injection. Ordinary medicinal treatment is carried out at the same time.

In two cases the sulphate was given intravenously, and the animals recovered. "The average dose would then be estimated at not more than half of the subcutaneous dose diluted to 1 per cent."

NAKAMURA (N.). **Investigation on a Diarrhoea in Young Chicks in Japan.**—*Jl. Japan. Soc. Vet. Sci.* 1922. June. Vol. 1. No. 2. pp. 93–101. With 1 plate. [Author's English abstract.]

The disease under investigation, known as Dabatare, occurs in chicks up to three weeks old. From his experiments the author concludes that the condition is distinct from white diarrhoea observed in other countries. The lesions appear to be more or less inconspicuous save that the kidneys are said to be somewhat atrophied and dotted with greyish white points, and the mesentery studded with numerous gas-containing cavities of different sizes.

The organism isolated was a Gram-positive anaerobe measuring 2–7μ by 0·8–1·5 μ. It was non-motile and non-sporulating. Acid and gas were produced in dextrose, laevulose, lactose, saccharose, maltose and mannite.

Feeding experiments were carried out with seven strains, and in all cases (41) the disease was produced in from 1 to 6 days, and death occurred in 3–13 days. Subcutaneous and intravenous inoculation failed to set up the disease and feeding experiments failed in birds more than seven weeks old.

The organism was pathogenic for rabbits, guinea-pigs and mice by intraperitoneal inoculation, and for pigeons by intramuscular inoculation. In the mammals, peritonitis and septicaemia were produced, and in pigeons, which died in from 1 to 3 days, there was also generalized infection and, in addition, gelatinous necrosis at the seat of inoculation. The bacillus was isolated from the soil on the premises where the

EMOTO (O.). **On the Nature of Lumbar Paralysis in the Goat.**—*Jl. Japan. Soc. Vet. Sci.* 1922. Mar. Vol. 1. No. 1. pp. 1–34. With 2 plates. [Author's abstract.]

A disease characterized by lumbar paralysis has made its appearance among goats imported from Switzerland, and their progeny. Only pure bred animals have been affected. The disease appears usually during the summer and autumn, and its onset is sudden. Cases vary in severity. In severe ones the animals are unable to stand. There are no discoverable lesions in the internal organs, but there is marked sclerosis of the spinal cord and inflammation of the pia mater.

In eleven cases examined bacteriologically a streptococcus was isolated from the spinal fluid, which was never found in healthy animals or in animals suffering from other diseases. Inoculation of 11 goats with cultures of this organism produced the symptoms and lesions found in natural cases.

HARVEY (W. F.) & IYENGAR (K. R. K.). **The Influence of Age and Temperature on Bacterial Vaccines. Part II.**—*Indian Jl. Med. Research.* 1922. July. Vol. 10. No. 1. pp. 192–202.

By means of killed cultures of the bacillus of fowl cholera preserved with phenol the authors have immunized batches of pigeons with accurately graduated doses, and have subsequently tested the birds with fully virulent cultures. The vaccines were kept at two temperatures, namely, room temperature (10–20° C.) and body temperature (37° C.). The latter was used designedly, as that temperature is commonly encountered in the plains of India for long periods at a time. At the same time the agglutinin content of the birds' bloods was tested. They found that vaccines stored at either of the temperatures showed no diminution of potency up to nine months, but deterioration set in after that.

The agglutinin content produced by the vaccine did not fall. They conclude, therefore, that the agglutinating power of the blood cannot be taken as an index of the protection afforded by inoculation.

HARVEY (W. F.) & IYENGAR (K. R. K.). **Retention of Virulence of a Micro-organism kept in Sealed Culture.**—*Indian Jl. Med. Research.* 1922. July. Vol. 10. No. 1. pp. 190–191.

The authors have previously shown that a culture of the fowl cholera organism retained its virulence without animal passage for at least a year when transplanted weekly upon blood agar. On ordinary agar there was great loss of virulence. The same organism was sealed up as a culture (presumably on blood agar) and kept at room temperature for twelve months. It was then tested in accurate doses on pigeons and found to have retained its full virulence. It is not stated whether the culture was exposed to light.

DISEASES DUE TO FILTERABLE VIRUSES.

VALLÉE (H.) & CARRÉ (H.). **Sur l'adsorption du virus aphteux.** [The Adsorption of the Virus of Foot and Mouth Disease.]—*Compt. Rend. Acad. Sci.* Paris. 1921. Jan. Vol. 172. No. 3. pp. 185–187.

If washed ox corpuscles are added to filtrate obtained from a suspension of epithelium taken from foot and mouth disease lesions, the virus becomes attached to the corpuscles and repeated washing and centrifuging does not free them from it. The blood corpuscles can be replaced by bacteria, such as staphylococci. The virus fixed in this way can be injected intravenously into susceptible animals in large quantities without producing the disease, but infection follows subcutaneous inoculation. The difference is explained by the difference in the rate of phagocytosis.

A single dose of adsorbed virus does not confer immunity.

An important point in connexion with the experiments is that caution must be exercised in concluding that a virus is intraglobular when microscopically nothing can be seen to substantiate that view.

SCHEIN (M.). **Dualité possible de la fièvre aphteuse. Hypothèse de travail.** [The Possible Duality of Foot and Mouth Disease.]—*Compt. Rend. Acad. Sci.* 1922. Jan. 16. Vol. 174. No. 3. pp. 204–206.

The author points out that foot and mouth disease is very variable in its manifestations. Sometimes a solid immunity is conferred and sometimes practically none. Man is sometimes infected and at other times escapes. Pigs likewise may or may not contract the infection from cattle, and the author states that on three occasions deliberate attempts to infect young pigs failed. It has been observed in practice that in some outbreaks the infectious nature of the disease is extreme, in others very slight. The period of incubation varies also within fairly wide limits.

He therefore suggests as a working hypothesis that there are in reality two specific entities included under the term foot and mouth disease. Similar dualities are known in human medicine.

GINS (H. A.) & WEBER (R.). **Ueber experimentelle Maul- und Klauenseuche.** [Experimental Foot and Mouth Disease.]—*Centralbl. f. Bakt.* 1. Abt. Orig. 1922. May 22. Vol. 88. No. 3. pp. 180–186.

The possibility of infecting guinea-pigs with at least some strains of foot and mouth disease virus has opened up possibilities of progress in the investigation of the disease. The authors have been able to do this, success in this direction having already been reported by WALDMANN & PAPE, HOBMAIER, and others. They have not been able to maintain the virus through so many passages as the first-mentioned authors. They found that the virulence decreased after the first half-dozen passages, and was lost also for naturally susceptible animals. In a few experiments the results suggested that this weakened virus was capable of multiplying in the blood of naturally susceptible animals and conferring immunity against subsequent infection. It was further found that guinea-pigs which had survived inoculation with weak virus were immune.

GINS (H. A.). **Mikroskopische Befunde bei experimentellen Maul- und Klauenseuche.** [Experimental Foot and Mouth Disease. Microscopic Investigations.]—*Centralbl. f. Bakt.* 1. Abt. Orig. 1922. June 12. Vol. 88. No. 4. pp. 265–268. With 1 plate & 2 text figs.

The author describes the presence of small bodies containing chromatin within the nuclei of the epithelial and sub-epithelial connective tissue cells in the neighbourhood of lesions produced experimentally in guinea-pigs.

LEBAILLY (C.). **La durée de la période contagiense dans la fièvre aphteuse.** [The Duration of the Period of Infectivity in Foot and Mouth Disease.]—*Rec. Méd. Vét.* 1922. Aug. 15. Vol. 98. No. 15. pp. 429–431. Also *Compt. Rend. Acad. Sci.* 1922. June 12. Vol. 174. No. 24. pp. 1580–1582.

The virus used in these experiments caused the appearance of symptoms in from 3 to 7 days. A susceptible animal placed in contact with an infected one from the first rise of temperature to the rupture of vesicles invariably became infected, the temperature rising in from 48 to 72 hours.

If, on the other hand, the susceptible animal is not placed in contact until four days after the appearance of the first vesicle, infection does not take place, even though the animals are placed in the closest possible contact. It is generally held that the risk of infection is very serious at this stage, and with a view to combating it very free use of disinfectants is advised. The author has, however, made a practice of placing fresh susceptible animals in contact with infected ones from the fourth day after the appearance of vesicles, and during a period of eight months has not observed a single case of infection. The use of disinfectants has been discontinued. The susceptibility of the contacts has been proved from a fortnight to a month later by inoculation or by exposure to natural infection.

It would therefore appear that there are two distinct stages in the course of the disease from the point of view of contagion. The first, during which animals are capable of transmitting the disease, which lasts until four days after the appearance of vesicles, and the second from that time onwards during which infectivity is absent.

The author holds that these observations indicate that slaughter is an unnecessary procedure, and offers the advice that the apparently healthy animals are more to be distrusted than those which have been salivating for four days.

VALLÉE (H.) & CARRÉ (H.). **Sur l'immunité anti-aphteuse.** [Immunity against Foot and Mouth Disease.]—*Rev. Gén. Méd. Vét.* 1922. June 15. Vol. 31. No. 366. pp. 313–317.

It has been well established that the immunity conferred by an attack of foot and mouth disease is exceedingly variable in duration, and that one of the factors concerned in this variability is the idiosyncrasy of the animal. Another factor is the quality of the virus, as has been shown in experiments in which animals recovered from an attack of the disease due to a particular strain of virus failed to become reinfected when inoculated with the same virus, but became affected when inoculated with a virus from a different source. Where reinfection took place there was a shortening of the period of incubation.

KURAGANO (S.) & MOGAMI (T.). **On the Immune Serum against Foot and Mouth Disease.**—*Jl. Japan. Soc. Vet. Sci.* 1922. June. Vol. 1. No. 2. pp. 111. [Author's English abstract.]

1. Calves subjected to natural infection proved to be immune against subcutaneous inoculation of virulent blood carried out 20–34 days after recovery. Further experiments are necessary to determine the duration of immunity.

2. Subcutaneous inoculation of blood, saliva, vesicular content and emulsion of spleen and lymphatic gland from an infected animal produced the disease in calves. The minimum lethal dose of blood for calves was 2 cc.

3. The blood serum from a recovered animal was found to have a protective action, and this could be strengthened by repeated injections of virulent blood (100, 500, 1,000 cc.).

4. The period of incubation is sometimes as short as 24 hours. It is therefore preferable to inject the serum first and the virus one or two days later.

5. Animals injected with immune serum at the rate of 0·53 cc. per kilo proved immune to 10 cc. of virulent blood three weeks later.

COSCO (G.) & AGUZZI (A.). **Studi sperimentali sull' Afta epizootica esequiti Nella R. Cascina di Poggio a Caiano (Firenze)—Giugno 1915–Ottobre 1919.** [Experimental Investigations regarding Foot and Mouth Disease carried out between June, 1915, and October, 1919.]—*La Clin. Vet.* 1922. June. Vol. 45. No. 8. pp. 1–140. With 3 plates & 10 charts.

In this paper are brought together results which have been published at different times during the period mentioned.

The length of the paper renders brief abstraction impossible.

HESLOP (G. G.). **Further Researches into the Serological Diagnosis of Contagious Pleuropneumonia of Cattle.**—*Proc. Roy. Soc. Victoria.* 1922. May. Vol. 34. No. 2. pp. 180–195.

The fermentation reactions of the virus have been tested, and it has been found that it will grow in Martin's broth with ox serum to which saccharose, glucose, maltose or lactose have been added, and, further, that growth also took place in 4–5 days in media containing 2 per cent. mannite or dulcite. In neither of these cases was acid or gas produced. In fact, no gas was produced in any of the media, and only glucose and maltose were rendered acid.

Attempts were made to simplify the method of applying the complement-fixation test in that 12 different antigens were tried in turn, but with none of them were satisfactory results obtained. Agglutination tests, using the microscopic method with dark-ground illumination, were carried out, but the method was found to be valueless.

It has, however, been found that positive results can be obtained by the microscopic method if an old strain of the organism which has been passed through several generations is used. Known positive serum will cause agglutination after 48 hours' incubation in a dilution of 1 in 100, while a known negative serum will give the same reaction in 1 in 80 only. The reaction is not complete until the forty-eighth hour. Incubating the tubes at higher temperatures did not expedite the reaction. Acute cases give higher reactions than chronic ones, as a general rule, but not invariably.

The tests have so far been carried out with sera from 23 positive cases.

In three or four cases animals affected with cowpox gave reactions to the complement-fixation test with pleuro-pneumonia antigen, which were to some extent positive. Details of these tests are not given.

DORSET (M.). **A Note on the Period of Incubation in Hog Cholera.**—*Jl. Amer. Vet. Med. Assoc.* 1922. July. Vol. 61. No. 4. pp. 393–396.

The author draws attention to the discordant opinions regarding the period of incubation of hog cholera, and indicates that these opinions have been based more extensively upon field observations than upon controlled experiments. With a view to making some exact observations, 171 pigs, varying from 50 to 80 lb. in weight, were inoculated subcutaneously with 2 or, in the great majority of cases, 5 cc. of virulent defibrinated blood. The animals were under close observation daily, and a tabular statement gives the percentage of animals on each day showing a rise of temperature, the first visible symptoms, loss of appetite, and died or killed for virus.

The period of incubation is taken as the interval elapsing between infection and the appearance of visible symptoms. A rise of temperature may not actually indicate infection as the temperature of pigs is very variable.

The shortest period elapsing between infection and the appearance of symptoms, sluggishness and slight loss of appetite, was three days, and the longest seven. In more than 95 per cent. of the pigs the period ended on the fourth, fifth and sixth days.

" It is coming to be recognized that successful immunization of hogs against hog cholera is primarily dependent upon the employment of a good grade of potent virus, first, by the serum manufacturer in hyperimmunizing his hogs and in testing his serum, and, second, by the veterinarian who is administering the simultaneous treatment in the field. The suggestion is made, therefore, that careful observation of the period of incubation of the disease in pigs inoculated to secure virus for any of these purposes may assist manufacturers in maintaining a virus of high grade."

The data obtained in the experiments under report suggest that a virus causing visible symptoms in a considerable proportion of pigs by the fourth day is either very virulent or contaminated.

The results also suggest that the best results will be obtained by the use of a virus, the incubation period of which is six days or less.

KONDO (S.). **On the Anti-rabic Vaccination in the Dog.**—*Jl. Japan. Soc. Vet. Sci.* 1922. Mar. Vol. 1. No. 1. pp. 47–51.

The author carried out a number of tests with vaccines prepared in different ways and gives the results of these in tabular form. The best vaccines were obtained by making an emulsion of brain from an animal inoculated with fixed virus, and killed when completely paralysed, in 50 per cent. glycerin containing 0·5 per cent. phenol in the proportion of 1 to 5 ; the emulsions being subsequently kept at 37° C. for 72 hours, or at room temperature for ten days before use. The former of these appeared to be the better, as the attenuation was more constant. Rabbits' brains were used in the earlier experiments, but subsequently the brains of dogs were employed. Better results were obtained and the yield of vaccine was larger.

A single subcutaneous inoculation with 5 cc. of this emulsion is sufficient to protect a dog against an inoculation with virulent material. The author states that the immunity lasts for about a year, but in his tabular statement the longest interval elapsing between vaccination and test inoculation is 101 days.

GALLI-VALERIO (B.). **Quelques observations au sujet du diagnostic de la rage.** [The Diagnosis of Rabies.]—*Schweiz. Arch. f. Tierheilk.* 1922. May. Vol. 64. No. 5. pp. 238–241.

The author diagnosed rabies in two dogs from the discovery of fragments of straw and wood wedged between the teeth and of sugar in the urine. In one of them he was unable at first to find Negri bodies, but these were subsequently discovered and the diagnosis confirmed by rabbit inoculation.

He also found sugar in the urine of the rabbits inoculated from these dogs, with the exception of one which died two days after subdural inoculation with medulla from one of the dogs. Death in this case was due, the author believes, to intoxication produced by the injected nerve tissue. This view has been held to explain cases of paralysis in human beings under treatment, but it has been found by REMLINGER that normal nerve tissue can produce neuro-toxic symptoms. Whatever be the explanation it is of importance, because a diagnosis of rabies must not be made because an inoculated rabbit dies soon after inoculation and before the presence of Negri bodies has been established or before another rabbit has been inoculated from it, and because it must be remembered that inoculated rabbits may die from this neuro-intoxication, and several therefore should be inoculated with the suspected material.

Moreover, the author states that the rabbit which died so shortly after inoculation showed symptoms resembling those of furious rabies. REMLINGER has noted the occurrence of similar symptoms in such cases.

The author advises direct inoculation into the substance of the brain in preference to subdural inoculation. He has had very good results with the following procedure. A stiff metal probe has wrapped round its end a pledget of cotton wool soaked in an emulsion of virus. This is then passed up the nostrils of the rabbit as far as the cribriform plate, where it is rotated, thus causing inoculation into the olfactory filaments.

BLANC (G.), MÉLANIDI (C.) & CAMINOPETROS (J.). **Recherches expérimentales sur une maladie eruptive de la chèvre observée en Grèce.** [Experimental Investigation of an Eruptive Disease of the Goat in Greece.]—*Ann. Inst. Pasteur.* 1922. Aug. Vol. 36. No. 8. pp. 614–618.

This disease is believed by the peasants to be caused by certain plants, among which is *Hypericum hirsutum,* which is known both in Northern Africa and in Greece on account of its phototoxic properties. The authors, however, claim to have proved the disease to be due to a virus belonging to the cowpox-sheeppox group.

FREI (W.). **Zur physikalischen Chemie der filtrierbaren Krankheitserreger.** [The Physical Chemistry of the Filterable Viruses.]—*Arch. f. Wissenschaft. u. Prakt. Tierheilk.* 1920. Sept. 15. Vol. 46. Nos. 3 & 4. pp. 103–139.

NICOLAS (E.) & RINJARD (P.). **La vaccination des Bovidés contre la peste bovine.** [The Inoculation of Cattle against Rinderpest.]—*Compt. Rend. Acad. Sci.* 1921. Dec. 19. Vol. 173. No. 25. pp. 1428–1429.

PAUCERA (A.). **Casi di afta trasmessa da bovini all' uomo e comportamento de virus riportato in animati sensibili.** [Cases of Foot and Mouth Disease in Human Beings.]—*La Clin. Vet.* 1922. May. Vol. 45. No. 6. pp. 251–254.

RIES (J. N.). **Sur le Diagnostic différentiel de la Peste Bovine.** [The Differential Diagnosis of Rinderpest.]—*Rev. Gén. Méd. Vét.* 1922. July 15. Vol. 31. No. 367. pp. 396–399.

MYCOTIC DISEASES.

FONTOYNONT (M.) & SALVAT (P.). **Sur une Actinomycose du Rat à Madagascar.** [Actinomycosis of the Rat in Madagascar.]—*Bull. Soc. Path. Exot.* 1922. July. Vol. 15. No. 7. pp. 596–607.

The first case of this infection was a rat caught at the Pasteur Institute at Antananarivo.

The lesions were abscesses along the tail and ulceration of the scrotum, the testicles were fibrous and contained cavities with viscous, creamy, yellow pus.

The left eye was very prominent, and the pupil was opalescent and yellowish-white in colour. The right eye showed only a small spot of opacity.

The peritoneum and mesentery were riddled with small abscesses. The pleura and pericardium were covered with miliary granulations.

In the pus the organism occurred in the form of small bacilli, cocco-bacilli or shuttle-shaped forms, only the walls of which took ordinary stains; it is Gram-negative and not acid-fast. Leishman's stain appeared to be the best.

Emphasis is laid on the fact that the organism is scarcely visible in smears of pus save in the very thinnest parts.

In cultures the organism is found to be composed of branching filaments which are sometimes slender and sometimes clubbed. They frequently have fragmented appearance, thus appearing as a chain of short bacilli or cocci.

The mycelium disappears rapidly in cultures, and only fragmented forms, rods, cocco-bacilli, etc., are found. These forms, the author believes, are not viable, as cultures are not obtained from pus which contains no mycelium. The failure of the various forms to take stains throughout is explained by the author on the grounds that they contain no protoplasm, only the empty envelopes becoming stained.

The optimum temperature for growth appears to be 37–38° C., but even at this temperature it is slow, a month being required to produce visible growth. Growth was always more luxuriant in tubes which were closed with rubber caps.

In primary cultures on such media as glycerin, glucose, or maltose agar, serum, and glycerinized carrots the colonies do not exceed 2 mm. in diameter, but under subcultivation luxuriant growths are obtained.

Details are given of the appearance of cultures on half a dozen of the media used.

After intraperitoneal inoculation with emulsion of pus, rabbits, guinea-pigs and rats died of acute intoxication within 48 hours.

By ingestion a chronic form of the disease was produced with the development of numerous abscesses. Small doses of pus injected intraperitoneally produced the same effect.

BOUCHER & CAROUGEAU. **Premier cas de Sporotrichose à** ***Sp. gougeroti*** **observé sur un cheval à Madagascar.** [The First Observed Case of Equine Sporotrichosis due to *Sp. gougeroti.*]—*Rev. Gén. Méd. Vét.* 1922. May 15. Vol. 31. No. 365. pp. 249–254.

The animal was a six-year-old stallion which had had persistent nasal discharge and enlarged glands for about two months before it came under the authors' observation. The general condition was good.

Examination of the nose revealed the presence of several sharply defined but irregularly shaped ulcers on the septum. These varied in depth, the deepest reaching the cartilage. They ranged from 1 to 3 cm. in diameter. The bases were covered with more or less adherent crusts, and when these were removed were found to have a downy appearance. The involved glands were as large as eggs, hard, and freely movable. There were a number of subcutaneous nodules varying in size from a pea to a nut above the angle of the mouth on each side.

Sporotrichosis was suspected, as there has been no glanders in Madagascar for many years, and an intrapalpebral test with mallein yielded a negative result. Pure cultures of *Sp. gougeroti* were obtained from the lesions on glucose agar.

Treatment with potassium iodide (15 g. daily) led to complete recovery in three weeks.

On glucose agar growth was visible as a black speck after 24 hours [temperature not stated]. By the third day the growth presented an appearance resembling the skin of a black mouse. After a week the growth was 5 mm. thick and from the fifteenth day showed a black non-filamentous border. Maximum growth was obtained after about a month.

On maltose agar there was a small amount of greyish-black growth on the second day, and two days later it was dotted with dry black spots, which caused it to resemble a mushroom. The development of filaments during the succeeding days masked this appearance.

Glucose gelatin.—Similar to those on glucose agar, but the colonies were greyish in colour, and on the second day showed a narrow white border. While the surface of the colonies remained greyish in colour, the deeper parts were black. Subsequently white filamentous outgrowths were observed growing into the substance of the medium.

Glucose broth.—On the second day there was slight turbidity, particularly at the bottom of the tubes. The following day a number of black specks were visible in the tube at the level of the surface of the liquid. Subsequently colonies developed on the surface of the medium and a small amount of black deposit at the bottom of the tubes. After a month there was a complete film on the surface of the broth, which had become clear, and a black sediment covered with a white albuminous layer 3 cm. in thickness.

The growth on potato was similar to that on other solid media.

The microscopic characters of the organism vary with the age of the culture. On the first day filaments composed of three or four oval elements measuring up to 20μ long and provided with thick double-contoured membrane are seen. On the second day long slender filaments composed of rectangular cells 2μ in thickness developed. On the following day lateral oval spores are found on these. By the fifth day moniliform filaments occur, with clusters of spores round the nodes, and on the following day spores are very abundant and short unicellular conidiophores giving rise to bunches of spores can be found.

Rats and rabbits inoculated subcutaneously died after periods ranging from a fortnight (in the case of the former) to four months (maximum of two rabbits); from some of the glandular lesions cultures were recovered.

One guinea-pig inoculated yielded a doubtful result.

Colin (M.). **Traitement chirurgical de la lymphangite épizootique.** [Surgical Treatment of Epizootic Lymphangitis.]—*Rec. Méd. Vét.* 1922. Aug. 15. Vol. 98. No. 15. pp. 431–436.

*Fontoynont (M.) & Carougeau. **Abcès sous-dermique et gommes ulcérées produits par le** *Sporotrichum carougeaui* **Langeron 1913, associé à la tuberculose chez un enfant malgache.** [Subcutaneous Abscess and Ulcerating Gumma caused by *Sporotrichum carougeaui*, associated with Tuberculosis in a Madagascan Child.]—*Bull. Soc. Path. Exot.* 1922. June. Vol. 15. No. 6. pp. 445–453.

*Langeron (M.). **Un nouveau Sporotrichum malgache :** *Sporotrichum carougeaui* **Langeron 1913, et remarques sur les Sporotrichés.** [A New Madagascan Sporotrix: *Sporotrichum carougeaui* Langeron 1913, and Remarks on the Sporotriches.]—*Bull. Soc. Path. Exot.* 1922. June. Vol. 15. No. 6. pp. 453–459.

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* Work dates from 1911. Publication delayed by the war.

MISCELLANEOUS.

Panisset (L.) & Havet (G.). **La proportion des Eosinophiles dans le sang des Bovidés.** [The Percentage of Eosinophile Leucocytes in Bovine Blood.]—*Compt. Rend. Soc. Biol.* 1922. Feb. 4. Vol. 86. No. 5. pp. 260–261.

The percentage of eosinophiles generally given for bovine blood is 1–2, but the authors have made a large number of examinations, and their average percentage is 11·7, with 5·4 and 18·6 as the minimum and maximum. The number varies not only from animal to animal, and from time to time in the same animal, but from preparation to preparation made from a single sample of blood.

To ensure, as far as possible, the absence of parasites which might have been responsible for eosinophilia, the urine and faeces of some of them were examined and precipitin tests for hydatid cysts were carried out.

In calves 1–2 per cent. is the normal.

Scharrer (R.). **Bovine Staggers or Pushing Disease in Natal.** —*Jl. Comp. Path. & Therap.* 1922. June. Vol. 35. No. 2. pp. 125–132. With 1 text fig.

Animals other than cattle can eat large quantities of *Matricaria nigellaefolia* without presenting the symptoms presented by the latter. They may, however, show irritation of the sexual organs, gastro-enteritis and nephritis.

The author has found that the toxicity of Matricaria is in direct relationship to the intensity of its scent. The scent appears to vary either with species or with locality. The primary symptoms of irritation which may be observed in all species of animals are, the author believes, the direct result of the essential oil present in the plant. The use of the plant thoroughly dried as hay or artificially dried is not responsible for the production of symptoms. The true "pushing" symptoms are not produced by feeding the dried plants. The peculiar susceptibility of the ox and the delay in the development of symptoms lead the author to think that the poisonous substance is not present in the plants as such, but comes into existence as a result of the breaking down of more complex substances. The toxic substance is probably eliminated slowly. The loss of condition he believes is due to the decomposition of the animals' own albumen in order to neutralize the toxin. "If the total amount of the Matricaria eaten is small, or the administration of large doses is spread over a sufficiently long period, the toxic analytical product can be neutralized by a certain chemical radical which is formed in the splitting up of the albumen of the body or food, and it can then be excreted in the urine." Pushing disease can therefore be prevented by giving foodstuffs containing much albumen, or the chemical radical which neutralizes the toxin after the albumen is broken up.

The incubation period is the direct indication of the amount of the plant eaten.

The acid reaction of the juice of Matricaria excludes the possibility of the presence of free alkaloids, and the improbability of free alkaloids being present is emphasized by the length of the period of incubation. The author thinks that the toxic substance must be an aromatic glucoside. By fermenting the glucoside in watery extract the author isolated the toxin, and his tests yielded results which were characteristic of phenol, and he states that carbolic acid produces exactly the symptoms of pushing disease in cattle, as they are unable to excrete it, as are other animals. Phenol can be identified in the carcasses of animals dead of pushing disease, and particularly in the nervous tissues.

With a view to effecting chemical combination with the phenol the author advises the administration of sodium hydrogen sulphite. The salt should be given 1 oz. twice daily in their drinking water (six pints) while they can drink. Drenching should not be practised, as there is partial laryngeal paralysis. For intravenous injections ⅓ oz. of sodium bisulphite in 200 cc. of water (sterile) at 100° F. are given. The injection should be made into the saphena vein with a view to lessening shock.

DODD (S.) & HENRY (M.). **Staggers or Shivers in Live Stock.**—*Jl. Comp. Path. & Therap.* 1922. Mar. Vol. 35. No. 1. pp. 41–61.

Staggers or shivers is the name given in certain parts of New South Wales to a diseased but non-contagious condition seen in horses, cattle and sheep in those areas.

It has not been proved that the condition is identical in the three species, but it appears to be probable that it is. The present paper deals with the disease as it is observed in sheep.

The condition appears to be confined to the flats along the Namoi river and its tributaries. These areas are subject to flooding and are, for the most part, practically devoid of grass, but covered after the rains with such plants as crowfoot, trefoil, thistle and mallow.

Age and sex appear to have no influence on the incidence of the disease, but it is said to be more severe in young animals. Even sucking lambs and foals may be affected. The disease is generally more in evidence after a good rainfall, but it has been seen in a dry season when only dried herbage was available.

The histories of outbreaks of the disease appear to have the common factor of sheep developing symptoms of staggers when called upon to make any effort, such as a journey. If the animals are rested recovery takes place; but some may die. The first symptoms which may be observed when the animals have travelled only a few hundred yards or after some miles are: stiffness of the hind legs, arching of the back, and head stretched out. Respiration is rapid and shallow and the pulse quick. If the affected sheep are urged, more or less extensive trembling of the muscles is seen. Then collapse occurs. If left alone they will get up and walk away, but if urged again death may occur. The temperature may range from 104–106° F. Sensory reflexes are absent, and there is no evidence of pain.

There are no lesions which can be ascribed to the disease itself. Attempts to transmit it by inoculation or contact have failed. It was first established experimentally that the disease was associated with a certain piece of land, which had previously been suspected of being causally connected with the condition.

The first evidence of the disease was observed in one lamb when the experimental animals were driven round the paddock two days after their introduction. The following day a number of them were affected. At this time there was a large amount of mallow in the paddock. An attempt was made subsequently to confirm this experiment with sheep brought from a distance. The disease did not make its appearance. This failure is explained by the fact that there were other plants such as trefoil in the meadow in plenty, and that the mallow was left untouched.

A number of feeding experiments were carried out in various ways, and from these the following inferences were drawn. Lambs are more susceptible to the toxic principle than adults; the toxin is conveyed to the lambs through the ewes' milk; either large quantities of the plant are necessary to produce symptoms in adults, or the plant is not so toxic in its early stages of growth.

In another experiment carried out with the cut plant carried to a distance and fed about 24 hours after cutting, lambs only were affected, and then after 24 days.

Evidence was obtained in one experiment that lambs which have been affected and have recovered are capable of becoming infected again when fed upon mallow.

Experiments designed to provide an answer to the question as to the stage at which the mallow was most toxic gave inconclusive results.

In view of the failure to cause symptoms in adult sheep in the above series of experiments a second set were carried out on similar lines, and symptoms were produced.

The view has been held by stockowners that *Lamium amplexicaule* (Labiatae) is also capable of producing symptoms of staggers, and experiment gave confirmation to this view; the plant would appear to be more potent than the mallow in that symptoms were produced in adults.

No evidence of fungus or other parasite of the mallow being responsible for the symptoms produced could be obtained.

No investigations regarding the nature of the toxic principle have been carried out.

As an addendum to the above article there is an extract of a letter headed "Injurious Effects of Malva Plant," by HESTER, which appeared in the *American Veterinary Review*, 1906, Vol. 30, p. 106. From this it appears that mallow (*Malva borealis*) was responsible for symptoms of staggers in horses in California.

MITCHELL (C. A.). **Preliminary Report on Equine Botulism in Canada.**—*Jl. Amer. Vet. Med. Assoc.* 1922. Vol. 61. No. 6. pp. 609–619.

The first suggestion that botulism might occur in animals was made by PEARSON in 1901, but no further investigations were made along these lines for many years because it was not known that *B. botulinus* might be a contaminator of foods other than meat, and because a number of investigators claimed to have detected the causal organisms of conditions variously known as forage poisoning, cerebrospinal meningitis, blind staggers, etc.

In 1918 the presence of *B. botulinus* on certain forage which had caused intoxication was detected by GRAHAM, BRUECKNER and PONTIUS.

BURKE in 1919 carried the work further, and amplifying that of DICKSON showed that there are two types, the antitoxin of either of which would not neutralize the toxin of the other. The author states that cases investigated in 1919, which had been diagnosed as cerebrospinal meningitis, he now feels sure were cases of botulism.

In October, 1921, four horses became ill simultaneously and all died within 24 hours. None of the others showed symptoms. A fortnight later a freshly purchased horse and the three remaining original ones became ill suddenly, presenting the same symptoms, and died within 30 hours. The only food common to all was hay. The water supply had been changed.

The lesions found were inconspicuous. The blood was dark and did not coagulate readily. The lungs, liver, spleen and kidneys were normal. The adrenals were slightly congested, as were the stomach and intestines. There was general engorgement of the cranial vessels.

The brain and cerebrospinal fluid yielded no growths on artificial media save for a few diplococci from the latter. These were non-pathogenic for guinea-pigs.

In anaerobic cultures from the intestines, growths were obtained of a bacillus which appeared to be *B. botulinus*. Subcultures were obtained in liquid media, and these, when freed from the bacteria by centrifuging, were found to be toxic. 0·2 cc. given intraperitoneally killed guinea-pigs, as did twice that dose given *per os*.

The characters of the organism were as follows : (1) strict anaerobe ; (2) Gram-positive ; (3) bacillus with rounded ends ; (4) terminal spores wider than the bacillus ; (5) short chains in liquid media ; (6) grew well at 28° C., not so well at 37° C. ; (7) produced a disagreeable rancid odour and gas ; (8) produced a powerful toxin.

Experiments carried out with antitoxins of the A and B types showed that the organism was *B. botulinus* type B.

A culture was grown in "minced-meat medium" for 16 days at 28° C. This was centrifuged and 5 cc. of the liquid were given to a horse *per os*. [The minced-meat medium was made by mixing equal weights of finely minced ox heart and water and cooking slowly. Normal soda was then added until the reaction was markedly alkaline to litmus. This was then autoclaved at 120° for an hour on three successive days.] For three days the horse appeared to be quite healthy. On the fourth day the following symptoms were noted: extreme difficulty in swallowing, salivation, dilatation of the pupils, ptosis, and extreme weakness. There was no sensory paralysis, and pulse and temperature were practically normal throughout. Only the head was examined post-mortem, and extreme congestion of the brain was observed. Smears from the brain revealed no bacteria and guinea-pig inoculations were negative.

The second experiment was carried out on an old horse affected with the "heaves" [? broken wind]. This animal was given 5 cc. of filtered toxin on oats. On the third day it collapsed and died suddenly. There were no very marked abnormalities found, but capillary congestion of the heart, lungs and abdominal viscera were the most pronounced.

In an experiment in which guinea-pig brain tissue was mixed with toxin, and the mixture injected into guinea-pigs after it had been incubated for five hours, the results indicated that there was no fixation of the toxin by the nerve tissue in that length of exposure.

It was found possible to precipitate the toxin with alcohol.

In an experiment with chickens the birds were found to be immune even to large doses, but guinea-pigs fed with food contaminated with excreta from the birds died.

The eggs of a fowl fed with toxin were not found to contain any. This is important in view of the use of raw eggs for children and invalids.

Production of toxin in vegetable media.—Oats were sprouted until they were about 4 in. long. The sprouts were clipped off, washed in sterile water and then packed firmly with glass rod in sterile tubes until the liquid expressed covered the surface of the pulp. Several such tubes were inoculated with *B. botulinus*. They were incubated at 28° C. for 10 days. *B. botulinus* was found along with moulds and yeasts, while the latter only were found in unsown control tubes. The liquid from the inoculated tubes killed guinea-pigs in doses of 0·5 cc. Liquid from control tubes was without effect. Clinical experience suggests that in hay *B. botulinus* is not distributed through a crop, but in pockets here and there.

WATSON (E. A.) & HEATH (L. M.). **Studies of Biological Preparations by Complement-Fixation Methods. 1. Mallein: Antigenic Variations and a Proposed Method of Standardisation.**—*Jl. Amer. Vet. Med. Assoc.* 1922. Aug. Vol. 61. No. 5. pp. 503–514.

Attention is drawn to the widely exploited preparations for the diagnosis, treatment and prevention of animal diseases, and their possible value for these purposes is commented upon, and the authors indicate the different procedures which they have tried with a view to arriving at some method of general standardization.

In this paper mallein standardization investigations are described.

They came to the conclusion that such products as mallein and tuberculin sera, vaccines, etc., could best be standardized by complement-fixation methods.

They found that horses treated with mallein yielded the best anti-mallein serum, and that the immunity was temporary, the antibodies disappearing in about a month. They could be restored by a fresh injection.

The antiserum was found to be specific. It yielded no reactions with products of other diseases, *e.g.*, tuberculin, nor with culture media.

IIZUKA (A.). **On the Disinfection of Animal Hairs.**—*Jl. Japan. Soc. Vet. Sci.* 1922. June. Vol. 1. No. 2. pp. 85–91. With 1 plate.

It having been found that boiling, steaming and autoclaving hair either damaged it or were objectionable for other reasons (slow drying, etc.), the author experimented with methods involving the use of formaldehyde gas *in vacuo*.

The general method in the preliminary experiments was to enclose bundles of horse-hair, within which were threads impregnated with anthrax spores rolled in paper, in a double-walled vessel. Hot water was placed in the outer space; it was kept at various temperatures in different instances for varying periods. The air within the vessel was then partly exhausted until the mercury manometer showed 3 cm. A solution of formalin 1 to 3 or 1 to 2 with water was poured in and the temperature maintained for a definite period.

The thickness of the bundles, the tightness of tying and the presence of dirt in the hair affected the results.

The anthrax threads removed from a bundle of hair 3 in. in diameter which had been exposed to the vapour of a 50 per cent. solution of formalin at 80° C. for three hours yielded cultures of anthrax subsequently. Similar bundles were effectively disinfected when the formalin solution was 1 to 4, the temperature 95–98° C., and the period half an hour.

Experiments were also carried out with an apparatus produced by a commercial firm termed the S.K. type vacu-form apparatus. The apparatus comprised a disinfection chamber with lead pipes on its inner side of a capacity of 15 cu. ft., formaldehyde producer, vacuum pump and boiler.

Steam is first passed through the lead pipes from the boiler, thus heating the disinfection chamber. The chamber and formaldehyde producer are then exhausted until the vacuum gauge indicates 29 in. Formaldehyde and vapour [water vapour] are then passed into the chamber and the temperature maintained for the required time.

The bundles of hair containing the anthrax threads and a considerable amount of dirt were placed in a box with a number of holes in its sides. Disinfection was incomplete when undiluted formalin was used, and the temperature kept at 85° C. for three hours. It was complete when formalin solution 1 to 4 was used and the temperature kept at 100° C. for half an hour.

Results apart from disinfection.—At temperatures below 100° the hairs are less moist. White or coloured hairs do not change colour or lose lustre. By steam disinfection white hairs become yellow. There was no loss of tenacity as shown by ascertaining the breaking strain and comparing with controls. Hairs disinfected by this method are difficult to bleach. The use of formalin prevents disinfected hairs from becoming musty if stored in a moist state.

Large apparatus constructed on very similar, but not exactly the same, lines were tested before being put into use.

The materials used were a little different in different cases:—

1. Horse hair was pressed down into a hole in a piece of wood and anthrax threads were buried in it at various depths In a similarly planned experiment a piece of lead tubing was used instead of wood. The temperature was kept at 100° for one hour and formalin solution 1 to 4 used. The spores were killed to a depth of 5 in. from the surface.

2. Conditions.—Temperature 85° C., formalin solution 1 to 2, time 1½ hours. Bundles of horse hair 2 in. in diameter and masses of hair 3 in. thick, each containing anthrax threads in their centres, were used. Both were disinfected when placed in the upper part of the chamber, but only the latter when placed in the lower part.

The superiority of the laboratory apparatus as compared with the commercial one is explained as follows. In the laboratory apparatus the chamber was small and heated from below, the bottom thus being hotter than other parts. This caused re-vaporization of any formalin falling to the bottom. In the other apparatus the heating was from the top, and when the temperature was 85° the upper part of the wall of the chamber was at nearly 100° C. and the lower part at 68° C. This excessive heating of the upper part caused the formalin to be overheated, diluted and reduced in total quantity. "On the other hand, the hairs absorb much formalin, so that the greater part of the early saturated formaldehyde is absorbed by the superficial portion of the bundle," and penetration is not complete, although penetration by heat is complete.

SUZUKI (S.). **Application of Papain in the Preparation of Culture Media.** —*Jl. Japan. Soc. Vet. Sci.* 1922. June. Vol. 1. No. 2. pp. 81–84. (In Japanese with English abstract.)

The technique described has been designed to obviate the necessity of adding peptone to media or, alternatively, the use of complex methods involving the use of digestive ferments of animal origin.

1. For general use. Mix one pound of horse-flesh or beef with 1 litre of water. Add 1·5 gm. of papain and boil or steam. As the temperature passes 85° C., 70 per cent. of the protein of the meat is converted into peptone. Filter and wash the residue with water. Mix water with the filtrate and make up the volume to 3 litres. Add 30 gm. of salt. The mixture contains about 2 per cent. of peptone.

2. For preparing materials for immunization. As above, save that the quantity of papain is reduced to 0·5 gm. and the total bulk made up to 1 litre. The peptone content is about 5·4 per cent.

COOLEY (R. A.). **Fourth Biennial Report of the Montana State Board of Entomology, 1919–20.** Helena. 1921. Jan. pp. 1–17.
PARKER (R. R.). **Report of Tick Control Operations in the Bitter Root Valley during the Seasons 1919 and 1920.**—*4th Bienn. Rept. Montana State Bd. Ent., 1919–20.* Helena. 1921. Jan. pp. 18–44. [Summarized in *Rev. App. Entomol.* 1922. June. Vol. 10. Ser. B. No. 6. pp. 123–124.]

Efforts have been concentrated on the control of *Dermacentor venustus*. This tick infests rodents in the larval and nymphal stages, and larger animals in the adult phase. The ground squirrel is the most frequent host of the immature ticks, but the rock squirrel, chipmunk, wood rat, weasel, snowshoe rabbit, cottontail rabbit and prairie dog are also susceptible to infection. Importance attaches to the possible responsibility of these species as reservoirs.

The eggs are laid in the spring or early summer. The larvae feed upon rodents for a number of days and then drop off. They remain quiescent till the following spring, when they appear as nymphs. These repeat the history of the larvae, save that the period of engorgement is a day or so longer. A second period of quiescence lasts until the following spring, when the adults appear. Ten days is the minimum period required for the engorgement of adults. Adults which fail to secure a host may survive for periods up to four years.

It has been found that dressings of kerosene or turpentine and lard serve to free animals from ticks " for long periods." Raw cottonseed and linseed oils also show promise for this purpose.

WELLS (R. W.), BISHOPP (F. C.) & LAAKE (E. W.). **Derris as a Promising Insecticide.**—*Jl. Econ. Ent.* 1922. Feb. Vol. 15. No. 1. pp. 90–95.

In this paper are described experiments in which powdered roots of *Deguelia* (*Derris*) *elliptica* were used against Mallophaga, including *Trichodectes scalaris* on cattle; Anoplura, including *Linognathus vituli*, L., and *Solenopotes capillatus*, End., on cattle, and *L. setosus*, Olf., on dogs; and *Ctenocephalus canis*, Curtis, and *C. felis*, Bch., on dogs and cats, and *Echidnophaga gallinacea*, Westw., on dogs.

The minimum dose required per animal to kill all fleas on various breeds of dogs was found to be 0·87 gm. of a mixture of derris and maize starch in equal parts. One treatment proved to be efficient for the destruction of all stages of Anoplura on cattle and dogs. It was also very efficient against Mallophaga on cattle and fowls, but not quite so effective on cattle as sodium fluoride. An ointment, consisting of one part of derris and two parts of vaseline, was applied to the orifices of warbles due to *Hypoderma lineatum*. In five days all the larvae were killed. Practically all the larvae were killed by a wash consisting of 1 lb. of derris, 4 oz. of soap and 1 gal. (U.S.) of water applied with a brush to the backs of infested cattle.

ROUBAUD (E.). **Les mouches Tsétsé en Afrique Occidental Française. Nos connaissances actuelles sur leur histoire et leur rôle pathogène** [The Tsetse-Flies of French West Africa. The Present State of Knowledge regarding their History and Pathogenic Powers.]—*Bull. Comité Etudes Hist. & Scientif. Afr. Occ. Française.* Paris. 1920. July–Sept. No. 4. pp. 257–300. 1 map. 7 figs. [Summarized in *Rev. App. Entomol.* 1922. June. Vol. 10. Ser. B. No. 6. pp. 117–118.]

This paper contains a map showing the distribution of tsetse-flies and trypanosomiases in French West Africa. The importance of Glossina lies in the fact that the life of the country is dependent upon the raising of cattle, and that flies of this genus live entirely on blood. Cold-blooded animals are attacked when others are not available, but the author has confirmed KLEINE's observation that flies living upon cold-blooded animals soon lose their fertility.

A key is given to the species of Glossina found and their distribution and habits are described. Seasonal migrations and the influence of meteorological conditions are explained. Their distribution is not entirely based upon conditions of vegetation or climate. *G. pallicera* and *G. fusca* are almost entirely limited to forest conditions. *G. tachinoides* and *G. longipalpis* are essentially bush species, but may be found in forest zones. *G. morsitans* is essentially the big-game fly, and hence is found in the plains. *G. palpalis* is frequently found in proximity to villages.

It has been found that the same species of Glossina is not capable of transmitting a given virus in every locality where it occurs. Nor are the trypanosomiases found to exist in different areas in proportion to the number of flies present, and in only a small proportion of flies which feed on an infective host does the parasite develop and become capable of infecting another host.

Clearing of land at suitable places has done much to reduce the fly population in those parts, and the process might be carried out in other favourable places.

GERLACH (F.). **Serumkrankheit bei Rind und Pferd.** [Serum Sickness in Cattle and Horses.]—*Zeitschr. f. Immunitätsforsch. u. Experim. Therap.* 1. Teil. Orig. 1922. Mar. Vol. 34. No. 1/2. pp. 75–94. With 4 charts & 2 text figs.

MENDELEEF (P.). **Rapport entre les Propriétés Cytotoxiques et anaphylactiques des sérums et leur teneur en ions H libres.** [The Relationship between the Cytotoxic and Anaphylactic Properties of Sera and their Content of Free Hydrogen Ions.]—*Compt. Rend. Soc. Biol.* 1922. Mar. 4. Vol. 86. No. 9. pp. 504–506.

STENT (S. M.). **Dubbeltje** (*Tribulus terrestris*) **and Geeldikkop in Sheep.**—*Jl. Dept. Agric.* (*Union of South Africa*). 1922. June. Vol. 4. No. 6. pp. 548–551. With 1 fig.

BOOK REVIEW.

SCOTT (William) [F.R.C.V.S.], with the collaboration of various writers. **An Indexed System of Veterinary Treatment.**—pp. xi + 636. With 195 illustrations. 1922. London: Baillière, Tindall, & Cox. [Price 31*s.* 6*d.* net.]

In this volume of some six hundred pages, the author has aimed at describing the treatment of "all, or nearly all, the diseases that animal flesh is heir to," and the methods of treatment described are said to be based upon "modern pathological and medical thought, supported by practical experience." Johne's disease (pp. 247–250) is said to be an unsatisfactory disease from a curative point of view, yet the author claims to have had satisfactory results during a period extending into "some years" from the administration of human urine in doses of one to three gallons in gruel night and morning. "No explanation is offered upon the therapeutical value of the urine, but it is a recognized fact that opsonins in considerable quantity leave the system by the urine, and a phagocytosis may be thereby stimulated by its ingestion."

Active immunization with full doses of Johne's bacillus vaccine is said to be worthy of an extended trial. One wonders where is the evidence to support this statement.

Joint evil (page 251). It is the author's experience that careful attention to the navel is valueless for the prevention of joint evil if the foal possesses a predisposition to the disease. It is to be regretted that the author gives no indication as to how this predisposition may be recognized. Tuberculosis (pp. 570–574) is, in the author's opinion, in many instances one of the most curable diseases with which the veterinary surgeon is called upon to deal, and two pages are taken up with the description of curative measures.

It is recommended that "open" pulmonary tuberculosis should be treated by means of a vaccine prepared from the organisms present in the expectorate to which tuberculin has been added.

The get-up of the book is up to the publishers' usual high standard.

A. L. Sheather.

MAGUIRE (L. C.) [F.R.C.V.S.]. **Vaccine and Serum Therapy in Veterinary Practice.**—pp. viii + 127. 1922. London: Baillière, Tindall, & Cox, 8, Henrietta Street, Covent Garden. [Price 5*s.*]

The first half of this small volume contains an outline of what has been published regarding what may be called the generalities of immunity, and in the remaining seventy pages the measures that have been devised for the control or treatment of some thirty diseases of animals are briefly described.

A. L. Sheather.

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